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Impacts to Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs

by Robert A. Dunn

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Impacts to Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs

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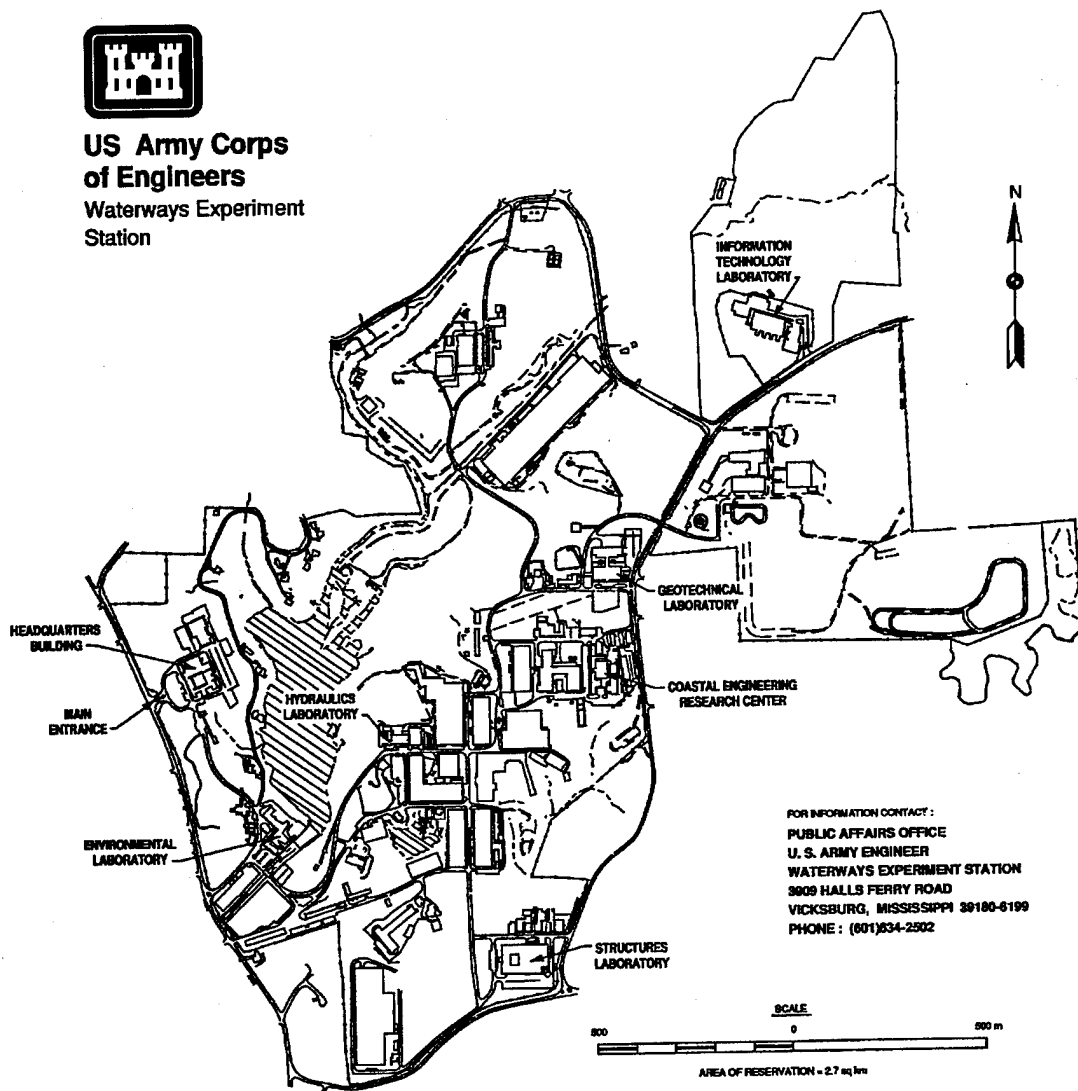
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US Army Corps
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Environmental Impact Research Program

Techniques for Effective Management
of Historic Properties on Lakeshores
and in Drawdown Zones



Impacts to Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs (TR EL-96-7)

ISSUE: The U.S. Army Corps of Engineers is required by Federal law and by its own regulations to protect "historic properties" (archaeological sites eligible for the National Register of Historic Places) from adverse impacts or to mitigate adverse effects through data recovery, site stabilization, etc. Sites located within the drawdown zones at Corps reservoirs are being adversely affected by fluctuating water levels caused by normal reservoir operation. Seasonal drawdowns cause a variety of erosion-related impacts and expose sites to human vandalism. Strategies must be devised to prevent or mitigate adverse impacts to these significant cultural resources.

OBJECTIVES: The major objective of this research work unit is to provide archaeologists and lake managers with the tools for more effective management of historic properties within the fluctuating drawdown zones of Corps reservoirs. The techniques and methodologies developed can be incorporated into project O&M manuals and Historic Preservation Management Plans. The research goal is to move beyond crisis management into thoughtful stewardship of the cultural resources under Corps control. To achieve this requires better delineation of the overall problem and clear guidelines for the treatment of such

properties, including long-term monitoring plans, data recovery options, and the use of effective site preservation techniques.

SUMMARY: This report deals with the nature and occurrence of impacts to historic properties along the shorelines and in the drawdown zones of Corps of Engineers reservoirs. It presents the survey questionnaire responses obtained from all Corps Districts and describes the management practices observed in field visits to nine Corps reservoirs. This report describes the scope of the "drawdown problem" and the variety of adverse impacts from erosion, biochemical effects, and vandalism. An overview of previous research to counteract these impacts is also presented.

AVAILABILITY: The report is available on Interlibrary Loan Service from the U.S. Army Engineer Waterways Experiment Station (WES) Library, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199; telephone (601) 634-2355. To purchase a copy, call the National Technical Information Service (NTIS) at (703) 487-4650. For help in identifying a title for sale, call (703) 487-4780. NTIS numbers may also be requested from the WES librarians.

About the Authors: Mr. Robert A. Dunn is an archaeologist at the WES, Environmental Laboratory. Point of contact is Mr. Dunn, telephone (601) 634-2380.

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Preface

The study herein was conducted as part of Work Unit 32881, entitled "Techniques for Effective Management of Historic Properties on Lakeshores and in Drawdown Zones," of the Environmental Impact Research Program (EIRP). The EIRP is sponsored by Headquarters, U.S. Army Corps of Engineers (HQUSACE), and is managed by the Environmental Laboratory (EL) of the U.S. Army Engineer Waterways Experiment Station (WES). Program Monitors were Ms. Cheryl Smith, Mr. Forester Einarsen, and Mr. Fredrick B. Juhle of HQUSACE. Technical guidance and review were provided by Dr. Frederick Briuer and Mr. Roger Hamilton, EL, WES, and by Dr. Clay Mathers, National Research Council Post-Doctoral Fellow in EL. Dr. Russell Theriot, EL, serves as the EIRP Program Manager.

Dr. Paul R. Nickens proposed the research to the Field Review Group of the EIRP in the spring of 1993 and served as Principal Investigator until his departure from WES in February 1994. Since November 1994, Mr. Robert A. Dunn has served as Principal Investigator.

The study was conducted under the general supervision of Dr. Robert M. Engler, Chief, Natural Resources Division, EL; and Dr. John W. Keeley, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

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Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
feet	0.3048	meters
miles (U.S. statute)	1.609347	kilometers

1 Introduction and Background

Description of Work Unit

The research work unit "Techniques for Effective Management of Historic Properties on Lakeshores and in Drawdown Zones" was proposed to the Field Review Group of the Environmental Impact Research Program (EIRP) in the spring of 1993. This research was funded to supplement and build upon the previous EIRP work unit that had produced the successful Archeological Sites Protection and Preservation Notebook (ASPPN).

As originally conceptualized, the present work unit had the objective "to provide cultural resource specialists and lake managers with the tools to undertake effective management of historic properties located within the fluctuating drawdown zones of Corps lakes." To achieve this overall objective, three research goals were proposed. These include the following:

- a. A better delineation of the overall problem, especially in terms of methods for improved impact assessment and quantification of effects.
- b. Development of techniques for efficient identification and evaluation of affected historic properties.
- c. Preparation of guidelines for treatment of such properties, including monitoring, data recovery, and preservation options.

The research project would be operationalized in the following manner. First, a survey would be conducted to ascertain the needs and requirements of Field Operating Activities (FOAs) and to provide a preliminary scoping of the dimension of the problem. Part of this first work phase would also include contact with each District to develop a list of lake projects where shoreline erosion and drawdowns occur and to identify potential sites for field visitation. Second, selected lakes representing a cross section of specific problem areas would be visited and interviews held with District and project personnel. Third, the results of the survey, field visits, and a concurrent literature search would be combined to provide guidance on developing impact assessment

models based on geological and geomorphic conditions, integration of Geographic Information System (GIS) databases, and strategies for protecting significant resource properties and data.

Due to a funding delay, research did not begin until January 1994. At that time, work began on an overall plan for approaching the problem, and discussions were held with a number of District archaeologists in an effort to identify the extent and magnitude of the problem. In a letter to the author dated December 15, 1994, the former Principal Investigator wrote, "Much of the thinking for this work unit came out of past involvement with the North Pacific Division (NPD), especially the Portland and Walla Walla Districts although archaeologists from the Seattle District were also involved." Preliminary plans were also made for a U.S. Army Engineer Waterways Experiment Station (WES) workshop on the drawdown problem to be held in Fort Worth, TX, at the end of the first year of research.

The proposal for a national workshop on the drawdown problem had to be discarded. A survey questionnaire, however, was prepared and distributed to all 37 Districts within the U.S. Army Corps of Engineers, and information copies were sent to the 14 Corps Divisions. The results of that survey questionnaire and the field visits it generated will form the nucleus of this report.

The primary objective of this initial research is to critically examine the hypothesis that impacts to significant cultural resources in drawdown zones of Corps reservoirs were severe in their effect, widespread in distribution, and constitute a major compliance problem for cultural resource managers within the Corps. A second objective is to provide an accurate description of the types of impacts that can and do occur in reservoir fluctuation zones. The third objective is to establish the baseline condition for cultural resource management (CRM) within the Corps of Engineers for this specific class of sites.

To achieve these objectives, a survey questionnaire was distributed to all Corps Districts, Corps archaeologists and lake managers were interviewed, nine operating projects were visited, and a review of the pertinent literature on impacts to archaeological sites within reservoirs was conducted.

Organization of Work Unit Reports

Two reports are scheduled to be produced for the work unit on "Techniques for Effective Management on Lakeshores and in Drawdown Zones." "Impacts to Historic Properties Within Drawdown Zones at Corps of Engineers Reservoirs" deals with the nature and occurrence of impacts to historic properties along the shorelines and in the drawdown zones of the Corps of Engineers (COE) reservoirs. It presents the survey responses obtained from the Corps Districts and describes the management practices observed in field visits to nine Corps reservoirs. An attempt is made to describe the scope of the "drawdown problem" and to quantify as much as possible the variety of

adverse impacts. Impacts from erosion, biochemical effects, and vandalism are discussed in detail. An overview of previous research to counteract these effects is also presented.

Another report scheduled for completion later this year will deal specifically with the techniques for effective management of historic properties that are subjected to the impacts described in this report. The later report will be built around three case studies to be conducted in the first half of fiscal year 1996 (FY96) and ongoing work by WES researchers for the Corps' North Pacific Division. Site evaluation, site protection and monitoring, the mitigation of adverse effect through data recovery, the prevention or control of vandalism, and the preparation of long-term management plans will be the major topics addressed. The successes or failures experienced by the Districts and by WES in past projects and in the conduct of the case studies prepared for this work unit will constitute the nucleus of this report. Finally, specific recommendations and guidelines for CRM, based on the research from both reports, will be presented.

2 Management Problem

Management Problem Created by Drawdowns

The management problem faced by Corps archaeologists, project managers, and high-level decision makers can be stated succinctly enough. There are numerous prehistoric and historic archaeological sites located within the floodpools of COE reservoirs. By law and regulation, the Corps is tasked to evaluate their National Register eligibility, to determine if they are being affected by the normal operation of the reservoir, to seek Advisory Council comment on ways to mitigate adverse effect, finally, to implement the negotiated treatment plan. In each step of this process, the Corps must coordinate with the State Historic Preservation Officer as an equal partner. This is the minimum required for compliance with the National Historic Preservation Act and ER 1130-2-438 (Project Construction and Operation-Historic Preservation Program). At the present time, Corps Districts vary widely in their progress toward full compliance. Hopefully, in the future, all Corps Districts will be able to reach the goal of stewardship set forth in the National Historic Preservation Act (Section 2-(3)). In certain areas of the United States and at certain projects, as will be shown in this report, this process has already begun.

At this time, however, the majority of Corps Districts face a multitiered drawdown management problem that can be usefully divided into three levels: identification, evaluation, and long-term management. Each level presents its own unique set of problems. All share one common feature. They cost money.

In the case of identification, with the majority of Corps projects, the number of sites located in the drawdown zone is not known because at most Corps reservoirs there was no comprehensive preimpoundment survey conducted. At a few lakes, preimpoundment sample surveys may have been conducted by the National Park Service or the Smithsonian Institution, or even by the Corps District. More often, however, a few opportunistic sample surveys of the shoreline and floodpool during drawdowns have taken place since the project became operational. The results of these surveys can be quite disheartening to archaeologists.

Where sites are recorded in actively eroding shoreline areas, the deflated lithic scatters encountered are not in their primary depositional context. They generally have no intact archaeological features and usually lack the integrity required for inclusion in the National Register of Historic Places. While surveys of these shoreline areas succeed in placing dots on quad sheets in the State's archaeological survey office, they generally do not recover data important for solving critical research questions.

When sites that are usually inundated are exposed by a significant draw-down, there is a much better chance that the site's integrity will be sufficient to allow meaningful data to be recovered through careful archaeological excavation and the analysis of associated features. The reality of this situation, however, is that when sites are inundated for most of the year or are sometimes only rarely available for inspection (e.g., every 5 or 10 years), much greater emphasis tends to be placed on the inventory completion of upland fee lands. Rarely will funding be available for site inventory in the exposed drawdown zone when the time comes. Yet, the sites located on the inundated terraces at Corps reservoirs may be far more important to the understanding of regional prehistory.

With regard to site evaluation, this vital procedure has only rarely been combined with the initial site recordation process. In most Corps Districts, only a small percentage of the total number of sites recorded on fee land have been tested or formally evaluated for the National Register. This is confirmed by a review of the data on site inventory submitted each year by the Corps Districts to the National Park Service for its Annual Report to Congress.

The legal requirement to identify and evaluate cultural resources is clearly codified in Section 110 of the National Historic Preservation Act (NHPA). However, within many Corps Districts, there exists an erroneous unwritten policy that there must be a Section 106 "Federal undertaking" (e.g., construction project and permit) before funds are made available for the intensive survey and testing required by most State Historic Preservation Officers (SHPO). Budgeting for site testing is usually tied to an imminent construction project. For that reason, the receipt of funding for testing/evaluation of sites in the drawdown zone is a rare occurrence. This is a distortion of the NHPA. Section 110, and not Section 106, is the applicable regulation for the inventory of reservoir drawdown zones.

The tragedy here is that the evaluation of sites in the drawdown zone is the key to their long-term management. Whether or not the sites are "Historic Properties" (National Register eligible) is unknown without formal testing/evaluation. Only in a few cases have sites been determined eligible for the National Register without this type of formal evaluation. To secure the funding and the manpower to do site evaluation, Corps Districts must acknowledge and comply with the inventory requirements of Section 110 of the NHPA.

Regarding the long-term treatment of archaeological sites that are determined to be "Historic Properties," the two options available to mitigate the

adverse effects of periodic inundation have been site protection or data recovery through archaeological excavation. To secure the funding and manpower to do this critical work, Corps Districts must acknowledge that operational reservoir drawdowns are "Federal undertakings" subject to the requirements of Section 106 of the NHPA, as codified in 36 CFR 800. However, the cyclic inundation and exposure of archaeological sites during annual drawdowns have more often not been regarded by Corps Districts as a "Federal undertaking." It is time that this erroneous interpretation of the NHPA also be discarded.

The question of whether data recovery or site protection is the better long-term management option must remain an open one for now. In many cases, it depends on individual site conditions. As a result of the research performed by WES Principal Investigators and their contractors, site protection has come to be recognized within the Corps as a technically feasible long-term management option. Given two decades of intensive research on site protection, perhaps it is also time to re-examine the conclusions reached by the National Reservoir Inundation Study in the 1970s, that in the majority of cases, data recovery is the most viable alternative for sites in a reservoir's fluctuation zone. In the later report for this work unit, dealing with the Techniques for Effective Management, site protection technologies will be discussed in detail.

1991 Site Protection Workshop

In 1991, WES EIRP organized a national meeting in Pierre, SD, entitled the "Archeological Sites Protection and Preservation Workshop." The present work unit is both a result and an extension of that highly successful workshop. The workshop combined a superb group of speakers and a national audience of archaeologists and resource managers. It included field visits and case studies that provided the workshop participants with the opportunity to observe firsthand the severe erosional impacts occurring to sites at the nearby Missouri River projects of Lake Francis Case and Lake Sharpe and to understand more fully the geomorphic processes creating these problems.

The workshop consisted of four major sections: Environmental Effects, Site Protection/Preservation Considerations, Management Considerations, and Planning for Site Protection Projects. The similarity of this organization to that of the present work unit is no accident. In the first section of this report, many of the topics touched upon in the Environmental Effects section of the 1991 workshop will be focused on with a narrower focus on shorelines and drawdown zones. These topics included Physical-Chemical-Biological Processes Affecting Cultural Sites, Geomorphological Processes, Impacts Resulting from Inundation, and Prediction of Sediment Erosion. The problem of human impacts will be looked at, which was a part of the Protection Considerations section of the 1991 Workshop.

Applicable Laws and Regulations

To fully understand the management challenge faced by the Corps' archaeologists and project managers, a brief overview of the major historic preservation laws and regulations pertaining to project operations is presented. Because focus here will be only on those sections pertaining to the management of historic properties in drawdown zones, the reader is encouraged to review these laws and regulations for a fuller treatment of their requirements.

National Historic Preservation Act of 1966 (as amended 1980, 1992)

Section 1(b)(2) of this landmark Act states that "the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people."

Section 2(3) states that it shall be the policy of the Federal Government to "administer Federally owned, administered, or controlled prehistoric and historic resources in a spirit of stewardship for the inspiration and benefit of present and future generations."

Section 110(a)(2) requires each Federal agency to "establish a program to locate, inventory, and nominate to the Secretary (Department of Interior) all properties under the agency's ownership or control by the agency, that appear to qualify for inclusion on the National Register in accordance with the regulations promulgated under 101(a)(2)(A). Each Federal agency shall exercise caution to assure that any such property that might qualify for inclusion is not inadvertently, transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly."

36 CFR 800 (Protection of Historic Properties)

This regulation implements Section 106 of the National Historic Preservation Act and constitutes the regulations of the President's Advisory Council on Historic Preservation. Section 106 requires a Federal agency head with jurisdiction over a Federally assisted, or Federally licensed undertaking to take into account the effects of the agency's undertakings on properties included in or eligible for the National Register of Historic Places and, prior to approval of an undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

Section 800.1(b) states the following on the purposes of the Section 106 process: "The Council seeks through the Section 106 process to accommodate historic preservation concerns with the needs of Federal undertakings. It is designed to identify potential conflicts between the two and to help resolve such conflicts in the public interest. The Council encourages this accommodation through consultation among the Agency Official, the State

Historic Preservation Officer, and other interested parties during the early stages of planning.” Sections 800.4 (Identifying Historic Properties), 800.5 (Assessing Effects), and 800.6 (Affording the Council an Opportunity to Comment) are relevant to the management of historic properties at Corps reservoirs and quite familiar to Corps archaeologists and resource managers.

Section 800.4(b) requires Federal agencies to “in consultation with the State Historic Preservation Officer...make a reasonable and good faith effort to identify historic properties that may be affected by the undertaking and gather sufficient information to evaluate the eligibility of these properties for the National Register. Efforts to identify historic properties should follow the Secretary’s “Standards and Guidelines for Archaeology and Historic Preservation” (48 FR 44716) and agency programs to meet the requirements of Section 110(a)(2) of the Act.”

Section 800.4(c)(1) states that in evaluating historic significance, the Agency Official shall “in consultation with the State Historic Preservation Officer and following the Secretary’s Standards and Guidelines for Evaluation, ... apply the National Register Criteria to properties that may be affected by the undertaking and that have not been previously evaluated for National Register eligibility.” The passage of time or changing perceptions of significance may justify reevaluation of properties that were previously determined to be eligible or ineligible. The next section of the regulation discusses procedures to be followed when there is agreement or disagreement between the Agency Official and the SHPO on site eligibility. For purposes of this report, it is important to note that when both agree that the site is eligible, the property shall be considered eligible for the National Register for Section 106 purposes.

Section 800.5(a) requires the Agency Official to consult with SHPO in applying the criteria of effect (Section 800.9(a)) to historic properties that may be affected, giving consideration to the views, if any, of interested persons. Subsequent subsections deal with the procedures to be followed for determinations of no effect, no adverse effect, and adverse effect. For purposes here, it is important to note that any time an eligible property will be affected, the Council must be contacted and documentation provided for review and comment. Adverse effects require the greatest amount of consultation and generally result in a negotiated Memorandum of Agreement (MOA) between the Agency, the SHPO, and the Council on how the adverse effect can be mitigated.

Section 800.6 deals with the procedures to be followed when the Advisory Council has been afforded an opportunity to comment when eligible properties will be (or are being) affected by a Federal undertaking. There are different tracks of coordination depending on whether there is an MOA. Most Federal agencies choose to develop MOAs in consultation with the SHPO and Council. In cases where no MOA is submitted, the Agency Official “shall request Council comment and provide the documentation specified in Section 800.8(d). When requested by the Agency Official, the Council shall

provide its comments within 60 days of receipt of the Agency's request and the specified documentation.

Foreclosing of the Council's opportunity to comment is not recommended. This act of defiance by a Federal Agency, such as the U.S. Army Corps of Engineers, can result in costly litigation and may halt a construction project as a result of a court's cease and desist order.

ER 1130-2-438 Project Construction and Operation—Historic Preservation Program

This regulation applies to all elements and offices involved with the construction, operation, and maintenance of civil works projects under the jurisdiction and control of the Corps of Engineers. It is not applicable to the Corps regulatory program.

Paragraph 4a of the regulation defines the object of the study here, "Historic Properties," as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places (National Register.)

Paragraphs 6a-6b provide policy guidance. The following excerpt is worthy of attention for the problem under consideration:

6a... "It is the policy of the Chief of Engineers to identify, protect, preserve, and manage the historic properties located on Civil Works Water Resource project lands. This is not intended to be restricted only to those properties actually listed in the National Register of Historic Places. Historic properties that have been nominated for the Register, determined to be eligible for nomination, for many purposes under the National Historic Preservation Act and its implementing regulations, are considered to have the same legal status as properties in the Register.

The following sections of the regulation should also be noted:

- a. *Section 8 (Historic Property Inventories/Site Evaluation).* "Historic property inventories and site evaluations, where not previously accomplished, should be conducted so that these resources are not inadvertently damaged or destroyed. Inventories are required in order that Corps controlled historic properties can be managed in a systematic and cost effective manner that meets Corps and public needs which assure compliance with the NHPA."
- b. *Section 10 (Inventory/Site Evaluation Priorities at Operational Projects).* "This and subsequent paragraphs guide District commanders in their treatment of historic properties at operational projects, most of which were completed prior to the passage of present day historic preservation legislation. Many such projects, therefore, contain

historic properties which have not been adequately and systematically inventoried and evaluated, or have been investigated on a haphazard or sporadic basis only. It is the intent of this regulation, where not already accomplished, to systematically and in orderly fashion accomplish inventory, evaluation, and any required mitigation studies to achieve full compliance with NHPA and related statutes. Budgetary and manpower constraints dictate that this undertaking cannot be immediately accomplished. It is the responsibility of District Commanders, in consultation with Division Commanders, to prioritize and schedule these investigations in accordance with the particular needs and requirements of each District and operational project."

"...Priority should be given to inventory and evaluate sites and areas that are being directly impacted or affected. The following criteria, listed in no particular order of importance, are suggested for use in determining project specific priorities. This listing is not all inclusive; District Commanders should use these or other criteria as appropriate to the situation.

(1) Imminence and degree of project related impacts.

(a) Pool fluctuation...."

c. *Section 19 (Enforcement Actions)*. Enforcement under 36 CFR 327, Title 36.

"...This is the only authority available to Corps of Engineers personnel for the protection of historic properties. Since the value of historic properties and associated costs resulting from unauthorized activities usually exceeds the maximum fine under Title 36, the enforcement actions necessary to investigate, prepare cases, and apprehend violators may be more appropriately handled by others under provisions of the Archeological Resources Protection Act."

Archeological Resources Protection Act of 1979 (ARPA). "ARPA provides for criminal penalties up to \$100,000 and/or two years imprisonment, and allows for forfeiture to the Federal government of equipment and vehicles used in unauthorized activities. In addition, civil penalties may be assessed to recover federal costs in repairing or restoring historic properties, accomplishing research and preparing reports. Since there is no enforcement authority under ARPA for Corps of Engineers park managers, rangers, archaeologists, or other staff, District Commanders shall follow procedures outlined in ER 190-1-50 to obtain services of the Criminal Investigation Command (CID) for such investigations, Commanders may also obtain services of the appropriate U.S. Marshal for immediate attention to suspected or known felony acts."

Management Challenge

A careful scrutiny of the applicable laws and regulations makes very clear the management challenge for the Corps with regard to archaeological sites in reservoir drawdown zones. The Corps is required to perform a complete, intensive, and systematic inventory of these lands. It is required to evaluate the identified sites for their National Register eligibility. Sites that are determined eligible by the Corps and SHPO will be managed in the same manner as those historic properties already listed in the NRHP. Historic properties, those determined eligible for the NRHP, will be preserved and protected, and adverse effects to these properties will be mitigated following prescribed consultation and negotiation with SHPO and the Advisory Council on Historic Preservation. To effectively manage these historic properties, a Historic Properties Management Plan will be prepared, implemented, and updated as required by ER 1130-2-438. The management challenge facing the Corps is, in a word, "stewardship."

In this report, the current status of Corps Districts in the face of this challenge will be discussed and an attempt made to define with greater precision the impacts that are occurring every year to the historic properties entrusted to their care.

3 Nature of Impacts

Geomorphic Processes and Impacts to Historic Properties

From a geomorphological perspective, archaeological sites are cultural deposits that can best be viewed as a component of the natural landscape. Saucier (1994:13-14) discusses this idea in the context of geoarchaeological investigations in the Lower Mississippi Valley:

“It is no wonder, therefore, that in the highly dynamic landscapes of the alluvial valley and deltaic plain, archaeologists have depended heavily on geomorphologists for an understanding of how the physical environment has changed in time and in space and influenced prehistoric human behavior. On the other hand, because of a need for more and better tools to understand landform and landscape evolution and changing natural processes, geomorphologists and geologists have relied heavily on archaeologists. Hence the development of an understanding, interdependence, and degree of interdisciplinary cooperation has yielded significant results. Over time, scientists have come to view archeological sites as a component of the natural landscape in the same context as natural levees, beaches, or abandoned stream channels, each has a role to play and a story to tell in reconstructing geologic history.... Archeological sites have immense importance as chronostratigraphic markers; in many cases, they provide the most reliable evidence as to the age of a landform or an event.”

The second concept to consider is that the reservoirs managed are really no more than flooded river valleys, highly altered fluvial systems. Prior to their impoundment, the rivers and their associated landforms were part of an overall fluvial system. After impoundment, they are still part of a dynamic and interactive fluvial system. In order to understand why toe scour and bank caving takes place in one part of a reservoir and siltation in another, one must understand the underlying geomorphic process. To effectively plan for future archaeological site protection or data recovery, it is essential to know how the fluvial system operates and when and how the cultural deposits within that system will be affected.

Smith and Patrick (1991:170) present an overview of the development of the concept of a fluvial system, noting seven important qualities:

- a. Limits of the fluvial system are environmental.
- b. Elements of the system interact.
- c. The fluvial system is controlled by previous actions.
- d. A single element usually dominates the fluvial system.
- e. The system evolves through time.
- f. Energy and matter flow through the system.
- g. Dynamics of the system are influenced by thresholds.

Human activities constitute an external variable that influences the evolution of fluvial systems. Looking at human intersection with fluvial systems, Smith and Patrick (1991:172-173) note the following:

“...in many cases, the effects of these modifications have been equivalent to several thousands of years of adjustment to a major change in climate or change in geologic environment...Man modifies a fluvial system by changing the character of the internal variables of the system such as vegetation, hydrology, and drainage network morphology. The result of man’s modifications of the fluvial system is feedback in the form of system changes in process and form.”

Geomorphologist S. A. Schumm (1977:133-137) examined the relation between water and sediment discharge in a river and certain characteristics of the river such as the following parameters: W , stream width; D , stream depth; s , stream slope; Mw , meander wavelength; S , sinuosity; W/D , width/depth ratio; Qw , water discharge; and Qs , sediment discharge. He demonstrated empirical relationships between these parameters in the following equations:

$$Qw = \frac{W \times D \times Mw}{s} \quad (1)$$

$$Qs = \frac{W \times s \times Mw}{D \times S} \quad (2)$$

What does this mean for the Corps archaeologist? If reservoirs are highly modified fluvial systems, they can be understood as a system. They are susceptible to geomorphic analysis. One can anticipate where and when erosion and sedimentation may take place in an artificial reservoir just as with a

natural fluvial system. In practical terms, one can anticipate erosion problems and plan ahead for the mitigation of adverse effects to the cultural deposits contained within the fluctuation zone of that reservoir.

Smith and Patrick (1991:173) made the following observation with regard to the empirical relationships proposed by Schumm:

“...an increase in water in the stream through a diversion of water into the system, would result in an increase in the width, depth, and meander wavelength, and a decrease in channel slope (Equation 1). Diversion of water from the river system would cause an opposite effect. When the sediment discharge of a stream increased through disturbance of the natural vegetation cover (agriculture or forestry), the channel width, slope, and meander wavelength increase while the channel depth and sinuosity decrease (Equation 2). Trapping of channel sediment behind reservoirs would result in a decrease in channel width, slope, and meander wavelength, as well as an increase in channel depth and sinuosity. These general relationships are useful in understanding not only the impact of man's works on a fluvial system but also the complex adjustment of fluvial systems to changes in hydrology.”

Using the fluvial system concept, Smith and his colleagues (Smith, Nickens and Corcoran 1995) have begun to develop analytical geomorphic models for studying site erosion problems at Corps reservoirs in the Pacific Northwest. As part of this effort, WES researchers are now preparing cultural resources monitoring and protection plans using these complex geomorphic models at several Corps reservoirs in the North Pacific Division. Such models make great use of modern GIS.

One practical result of this effort is the development of cultural resources monitoring plans. The objective of such a plan, as proposed by Smith, Nickens and Corcoran (1995), is to determine with the greatest possible precision how archaeological sites and other traditional cultural properties at a given reservoir are being (or may be) affected by the geomorphic processes identified in the analytical geomorphic model and present human use of a particular reservoir.

Development of a detailed monitoring plan would appear to be an essential first step in preventing site destruction and the loss of scientific data. A monitoring plan integrated with an analytical geomorphic model can provide the Federal land manager with the geomorphic conceptual tools and the baseline data on site conditions needed for successful cultural resource management. This is particularly true when used in conjunction with a GIS.

The potential of landforms within a project area to contain significant cultural deposits can be assessed using the analytical geomorphic model. A conceptual model for site impacts, both geomorphic and anthropogenic impacts, can then be created and incorporated into a GIS database. In addition, a site monitoring program can then be designed that will set forth guidelines and methods/technologies and identify additional inventory and

evaluation needs. The monitoring program is then refined following an initial pilot study and, thereafter, modified by the periodic re-examination of site impact data (Smith, Nickens, and Corcoran 1995).

This technique and its potential for effective management of sites in draw-down zones will be discussed in detail in a later report for this work unit. For now, it is sufficient to note that the landforms, containing cultural deposits, are part of a fluvial system that operates in a predictable manner. The challenge to the resource manager becomes one of understanding the way in which the elements of the fluvial system interact, and anticipating adverse impacts to the significant cultural resources located within that system.

Geomorphic models have a valuable role to play in helping cultural resource managers plan for the mitigation of adverse effects resulting from shoreline erosion. Nevertheless, the geomorphologist's assessment of the potential of specific landforms to contain cultural deposits should not be regarded as a substitute for archaeological predictive modeling. Archaeologist W. C. Mathers argues effectively that:

"Geomorphological models are only part of the story and do not account for many aspects of human activity such as warfare, ritual, and exchange which often produce components of the archaeological record which are more rare, less visible, and therefore less easy to predict than many of the types of sites that are often the focus of geomorphic models. There is, therefore, a role for archeological predictive modeling which is complementary to, but in some respects - at least - separate from, geomorphically derived models of landscape development."¹

National Reservoir Inundation Study

Ware (1989:3) provides a useful summary of the findings of the National Reservoir Inundation Study (NRIS) on the effects of inundation on archaeological resources:

"In 1975, four Federal agencies, the National Park Service, the Bureau of Reclamation, the U.S. Army Corps of Engineers, and the Soil Conservation Service, determined to resolve the debate (beneficial vs. adverse effects of inundation) through intensive research. The result was the NRIS, a 5-year program designed to conduct basic research on the effects of freshwater inundation on cultural resources. After 5 years of field and laboratory research on inundation processes and cultural impacts, the NRIS concluded: (a) the effects of freshwater inundation on archaeological resources are overwhelmingly detrimental, (b) some archaeological values are more susceptible to adverse impacts than others, (c) in situ site protection is a viable mitigation alternative

¹ Personal Communication, 1995, W. C. Mathers, archaeologist, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

to excavation only in limited circumstances, and (d) archeological mitigation plans should be incorporated into the reservoir construction planning as early as possible in order to effectively address the entire range of adverse effects.”

The NRIS report authored by Lenihan et al. (1981) discussed potential effects within five discrete zones of differential impact. The number of reservoir impact zones was reduced to three by Ware (1989:20):

- Zone 1 Conservation Pool - That portion of the reservoir below the average annual drawdown.
- Zone 2 Fluctuation or Drawdown Zone - The zone exposed to periodic, usually annual, shoreline fluctuation.
- Zone 3 Backshore Zone - The upper, noninundated reaches of the reservoir watershed.

Ware (1989:20) provides this summary description of the differential impacts:

“During the initial flooding of a reservoir, mechanical impacts predominate, but after the permanent pool is established (Zone 1) and in the absence of underwater slumping and soil movement, the dominant processes impacting cultural resources are biochemical in nature. Within the fluctuation zone of a reservoir (Zone 2), mechanical impacts of wave and water motion will dominate during the life of the reservoir, although biochemical and human impacts are also very active in the littoral zone. In the Backshore zone (Zone 3), in areas of the reservoir basin that are rarely if ever inundated, the dominant impacts will be human and land use related.”

In the discussion to follow, the focus will be specifically on Zone 2 impacts, and the mechanical, biochemical, and human impacts that the NRIS documented will be examined. The discussion will then expanded to include the results of other drawdown zone research.

Impacts to Sites in Drawdown/Fluctuation Zones

Ware (1989:10) defines three general categories of site impacts. The first consists of impacts created by mechanical processes. These include a variety of physical erosion and deposition processes, including wave and water motion, reservoir siltation from backshore runoff and stream inflow, and saturation and slumping of shoreline and submerged geological strata. The NRIS report determined that wave action in shallow water is the most important mechanical impact to cultural resources in reservoirs.

The second category of impacts are those resulting from biochemical processes. This category affects the differential preservation and destruction of

inundated cultural materials. The NRIS found that the chemical composition of a freshwater reservoir is primarily a function of climate, geology, biota, human activity, and time.

The third category of impacts results from the consequences of human activities. While the focus will be primarily on vandalism in the drawdown zone, human activities affecting sites in the drawdown zone also include dam construction, recreation, and continuing changes in land use.

When the NRIS looked at impacts in the drawdown or fluctuation zone of a reservoir, it found "virtually all categories of cultural resource impacts are magnified, with mechanical hydrological impacts constituting the greatest threat to cultural resources" (Ware 1989:26). One of the reasons for this is that a fluctuating pool prevents the development of an equilibrium beach profile.

The average reservoir shoreline will eventually achieve an equilibrium profile if the reservoir water level remains relatively stable. As waves attack a newly formed shoreline, fine silty materials are removed to deep water and deposited as a heavier fraction in an offshore shoal. As the size of the offshore shoal increases, wave energy reaching the shore decreases, until a certain limiting form is achieved in which most of the wave energy capable of eroding the shore is dissipated in the offshore shoal (Ware 1989:11). If, however, the pool fluctuates, as in a seasonal drawdown, the offshore shoals are eroded and wave action begins to attack the shoreline again. The end result is that "reservoirs subjected to large annual pool-level fluctuation may never achieve stable shoreline profiles" (Ware 1989:11).

Fluctuating pool levels will enlarge the zone of destructive wave action by increasing the effective beach zone of a reservoir. The NRIS found the following:

"As the reservoir pool level draws down, breaking waves strike the saturated and unconsolidated sediments of the reservoir basin which have already been deprived of a protective vegetative cover. These fragile sediments are susceptible not only to wave erosion but also to subsequent wind and water runoff erosion within the exposed drawdown zone" (Lenihan 1981).

Other important factors determining the nature of mechanical impacts include the slope, orientation, exposure, and constituency of the shoreline geology. Ware (1989:27) notes that the slope of the reservoir basin is particularly important:

"Steep to near-vertical slopes of poorly consolidated sediments encourage the development of erosional cutbanks where wave action gradually undercuts a vertical face, resulting in the slumping of unsupported blocks of soil. On Oahe Reservoir and other impoundments along the Missouri mainstem in South Dakota, shoreline cutbank erosion of poorly consolidated loess deposits is so severe that dozens of important archeological sites are currently

threatened. On flatter reservoir slopes, sheet erosion is more common, and on nearly flat terrace slopes, erosion is minimal.”

In general, the NRIS concluded that the nature and extent of shoreline mechanical impacts to sites were affected by four variables:

- a. Reservoir size, depth, orientation, local climatic regime, and the operating characteristics of the reservoir.
- b. Cultural site location relative to reservoir fetch and prevailing wind patterns.
- c. Site geological and environmental context (especially the slope and erosion resistance of basin geomorphology).
- d. Character and erosion resistance of cultural deposits.

Regarding specific high-energy impacts to archaeological sites, the NRIS showed that the relationships among the objects comprising a site are more susceptible to high-energy mechanical impacts than the objects themselves. Archaeological context, provided by the soil matrix, is often the first thing to be lost when a site is subjected to shoreline erosion. The NRIS reported that waves and nearshore currents can dislodge and displace large artifacts and that impacts to architectural features and archaeological-midden deposits also occur.

Another major impact to historic properties in the drawdown zone is the frequent wetting and drying of cultural deposits. The NRIS performed a series of laboratory experiments in which a variety of common cultural materials were subjected to multiple wet/dry cycles. It concluded that alternate wetting and drying exposure contributes to the rapid deterioration of common organic materials and that much of the deterioration occurs after only a few exposures.

The NRIS also found that the potential for biochemical and human impacts on the shorelines of reservoirs is greater than in any other reservoir zone:

“Biochemical activity is accelerated in the shallow waters of the reservoirs littoral zone because of higher light, dissolved oxygen levels and ambient temperatures. These conditions will support more organisms that may degrade perishable cultural materials. Similarly, the potential for human and faunal impacts is greater in the shoreline fluctuation zone than in any other reservoir zone. Human recreation and all its attendant impacts are concentrated at the reservoir shoreline: boat ramps, swimming beaches, campgrounds, recreational vehicles, power boats, and their destructive wakes are all potential sources of adverse impact to fragile cultural resources....As human use and visitation of the lake shore increases, vandalism invariably increases. Since native vegetation is often deflated along the periodically

inundated shoreline, cultural resources are often highly visible and, therefore, more susceptible to human impact" (Ware 1989:28).

In the next several sections, the Corps' previous research and development (R&D) efforts in dealing with mechanical, biochemical, and human impacts to historic properties at its reservoirs will be briefly examined. Following that, the management situation in the field, based on the survey questionnaire and field visits, specifically as it pertains to sites in the drawdown zone will be discussed. The contrast between the ideal world of R&D and the real world of FOAs will effectively define the scope of the drawdown management problem.

4 Previous Research

Environmental Impact Research Program

The Environmental Laboratory (EL) of WES provides technical support to the Army, the Department of Defense, and numerous other Federal agencies in an impressive number of scientific and technical fields. Since the mid-1980s, EL's mission has included archaeological site protection and preservation. Funded through the EIRP, the Center for Site Preservation Technology at WES has produced the internationally recognized ASPPN and numerous other technical reports and workshops on this aspect of cultural resource management. The EIRP also funded the 1992 WES video entitled "Engineering Solutions for Heritage Preservation." A brief overview of EIRP-sponsored research is presented next.

Environmental Engineering Approaches

As part of the EIRP-funded Site Protection and Preservation Workshop, Shields (1991) organized the voluminous engineering literature on streambank erosion control into taxonomic categories. His organizing principle was the recognition that different protection techniques are not equally effective against all erosion mechanisms. His site protection taxonomy can be used by the archaeologist or resource manager to select a technique for a given archaeological site based on the causes of mechanical erosion at the site, the nature of the threatened resource, and other considerations such as economics. These categories can provide a quick overview of protection measures available for coping with mechanical impacts.

Bank erosion of rivers and reservoirs can be caused by several different mechanisms. These include bed degradation, direct attack by streamflow, waves and water-flow fluctuation, water-flow over and through banks, freeze-thaw, and debris action. Figure 1 (Shields 1991: Figure 12) is a matrix of streambank erosion mechanisms versus streambank protection methods described in the engineering literature. Selection of a method for a specific archaeological site should start with the identification of the primary erosion

Bank Protection Method	Erosion Mechanisms											
	Toe Erosion With Upper Bank Failure	Scour in the Middle and Upper Banks by Currents	Local Scour	Erosion of the Noncohesive Layers in Stratified Alluvium	Erosion of Local Lenses of Noncohesive Sediment	Erosion by Overbank Runoff	General Bed Degradation	Headcutting	Erosion by Piling	Erosion by Navigation Waves	Erosion by Wind Waves	Erosion by Ice and Debris Gouging
Flow diversions and slope drains	No	No	No	No	No	Yes	No	No	Yes	No	No	No
Drop inlet storm drains	No	No	No	No	No	Yes	No	No	Yes	No	No	No
Cobble or gravel armor	No	No	Yes	No	No	No	Yes	No	No	No	No	No
Low vanes	Yes	No	Yes	No	No	No	No	No	No	No	No	No
Gabions	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
Cobble revetment	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
Cellular block concrete revetment	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
Covering riprap with soil and grass or ground cover	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
Live cribwalls	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
Brush mattresses	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
Bank shaping and establishment of woody vegetation	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
Geotextiles and vegetation	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No
Clay blankets with vegetation	No	Yes	No	Yes	Yes	No	No	No	No	No	No	No
Rock toe protection with vegetative treatment of upper banks	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
Hard points, jetties, and earth core dikes with vegetation	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Riprap with live stakes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Window revetment	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Tree reefs, pendants, and revetments	No	Yes	No	No	No	No	No	No	No	No	No	No
Bank shaping and establishment of grass or ground cover	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
Jack fields	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No

Figure 1. Streambank erosion mechanisms and streambank protection methods (Shields 1991)

mechanism. Specific protection methods for each category of erosion are listed below:

Channel Bed Degradation

Grade Control Structures

(Inclusion of other measures after degradation is halted)

Direct Attack by Streamflow

Direct Protection

Monolithic (rigid) cover

Granular cover

Matting cover

Bulkheads

Vegetation (upper bank)

Clay blanket and soil stabilization

Indirect Protection

Transverse (spur) dikes

Parallel dikes (retards)

Waves and Water-Level Fluctuation

Direct Protection (as listed above)

Breakwaters

Water Flow Over and Through Bank (Related to water-level fluctuation)

Flow diversions and slope drains or drop pipes

Some types of direct protection

Slope stabilization

Freeze-Thaw and Woody Debris Action

Direct Protection (as listed above)

Indirect Protection

Debris Removal

It is also important to note here the research on site protection techniques conducted by Dr. Robert Thorne, Director of the National Clearinghouse for Archeological Site Stabilization, at the University of Mississippi. In a series of excellent monographs, he has provided cultural resource managers with a comprehensive review of archaeological site stabilization techniques and how they can be adapted to particular site conditions (e.g., Thorne 1988). Thorne (1991) has also provided a comprehensive listing of sources of technical information to support archaeological site stabilization projects. A detailed discussion of this literature will be undertaken in a later report for this work unit.

Archeological Sites Protection and Preservation Notebook

The ASPPN was issued in 1992 as part of EIRP Work Unit 32357, "Field Preservation of Cultural Sites." The notebook has been, and will continue to be, updated from time to time by supplements and revisions that, like the initial contents, take the form of technical notes in a loose-leaf format. Recently, 1,400 copies of the ASPPN were reprinted using funds provided by the Department of Defense Legacy Resources Management Program. These notebooks were distributed to all Department of Defense installations and to all Corps Districts, as well as numerous other Federal and State agencies and educational institutions.

Technical notes are primarily prepared by WES project personnel and contractors; however, other Corps of Engineers personnel and individuals in other agencies and organizations concerned with site protection needs may submit items for publication. These technical notes include the summarized results of two forms of inquiry: original research contracted for under the EIRP work unit and accounts abstracted from published and unpublished reports, many of which have been abstracted into an electronic database. The primary concerns of these technical notes include the nature of impacts causing site degradation and techniques used or suitable for in situ site protection, including those that, even though not yet tested, may be applicable.

The technical notes are organized by protection categories such as I-Impacts, II-Site Burial, III-Structural Stabilization, IV-Soil and Rock Stabilization, V-Vegetative Stabilization, VI-Camouflage and Diversionary Tactics, VII-Site Surveillance, VIII-Stabilization of Existing Structures, IX-Faunal and Floral Control, X-Signs, and XI-Inundation. Shown below is the interface of Shields'(1991) site protection taxonomy with the ASPPN categories. The Roman numerals listed below refer to ASPPN technical notes that provide examples. For example, III-4 would be technical note number 4 within protection category III (Structural Stabilization):

Indirect Protection

Grade Control Structures

Weirs

Modification of Flow Alignment

Transverse (spur) dikes

permeable (board fences, Kellner jacks, etc.)

impermeable (stone) III-4 (gabion groins)

Parallel Dikes (Retards)

permeable (board fences, Kellner jacks, etc.)

impermeable (stone) III-4 (rock-filled log cribs)

Vanes

Removal of large woody debris

Flow Diversions and Slope Drains

Direct Protection

Monolithic Cover (concrete, asphalt, grouted riprap) II-2 (gunite)

Granular Cover (gravel, riprap, soil cement blocks, rubble, etc.)

III-2, III-4, III-4 (riprap); III-9 (Filter cloth and riprap);

III-10 (rubble)

Windrow or trenchfill

Matting Cover (fabrics, gabions, auto tires, lumber mattress, etc.)

III-5 (logs)

Bulkhead III-1 (gabion), III-3 (sheet piling), I-17 (wood)

V-2 (timber crib with vegetation)

Vegetation V-2 (Woody vegetation with floating breakwater)

V-1, IX-2

Clay Blanket

Soil Stabilization

Slope Stabilization

Excavation to reduce bank height or angle

Subsurface Drainage

Retaining wall (bulkhead) III-1 (gabions)

Biotechnical Approaches to Erosion Control

Another major research focus of the EIRP, and one that is reflected in the technical notes of the ASPPN, is the biotechnical approach to surface and shoreline erosion control. This approach combines the use of vegetation and engineering structures or building materials. Much of this research has been performed by the WES EL. Allen (1991) presented this approach to the workshop participants at Pierre, SD. Three elevation zones are considered: the splash zone, the bank zone, and the terrace zone. Each zone will require different types of vegetation and different planting techniques.

Due to the focus on drawdown impacts, only the splash zone and bank zone conditions and requirements will be briefly considered here. The splash zone is that portion of the bank between normal high-water and normal low-water flow rates. This is the zone of greatest stress:

“The splash zone is exposed frequently to wave-wash, erosive river currents, ice and debris movement, wet-dry cycles, and freezing-thawing cycles. This section of the bank would be inundated throughout most of the year (at least 6 months/year). The water depths will fluctuate daily, seasonally, and by location within the splash zone” (Allen 1991:4).

The bank zone is that portion of the bank usually above the normal high-water level:

"This site is exposed periodically to wave-wash, erosive river currents, ice and debris movements, traffic by animal or man. The site is inundated for at least a 60-day duration once every two to three years. The water table in this zone frequently is close to the soil surface due to its closeness to the normal river level" (Allen 1991:4).

The planting techniques recommended in the splash zone include sprigging, sodding, reed/plant rolls, and the use of fibroscines. In Allen's case study on the upper Missouri river, only herbaceous semiaquatic plants like reeds, rushes, and sedges were used because these types of plants can tolerate considerable flooding and are more likely to survive:

"Reeds (i.e., common reed and bulrush) also protect stream banks in various ways. With their roots, rhizomes, and shoots, they bind the soil under the water, sometimes even above the water. In the reed zone along the riverbank, they form a permeable underwater obstacle which slows down the current and waves by friction, thereby reducing their impact on the soil. Active protection of the bank can be ensured by reeds only in an area which is constantly submerged such as below the average water level" (Allen 1991:5).

Both herbaceous (e.g., grasses and clovers) and woody plants were used in the higher bank zone. Allen recommends that these should still be quite flood tolerant and able to withstand partial to complete submergence for up to several weeks:

"Various willows can be used in this zone, but they should be shrublike willows such as peachleaf willow (*Salix amygdaloides*) and basket willow (*Salix purpurea* var. *nana*). Edminster et al. (1949) and Edminster (1949) describe successful use of basket willow for streams and rivers in the Northeast. Shrub-like willow, alder, and dogwood species have been used in Europe successfully. Red-osier dogwood (*Cornus stolonifera*) and silky dogwood (*Cornus amomum*) also have been used in the Northeast. Selbert (1968) notes that in periods of high water, the upper branches of such shrubs reduce the speed of the current and thereby the erosive force of the water. The branches of such shrubs have great resilience, springing back after currents subside. This springing resistance divides the water and slows it down by friction" (Allen 1991:5).

The advantages of incorporating vegetation are numerous:

"First, the root systems help hold the soil together and increase the overall bank stability by this binding network structure. Second, the exposed vegetation (stalks, stems, branches, and foliage) can increase the roughness resistance to flow and reduce the local flow velocities, causing the flow to dissipate energy against the deforming plant away from the soil—energy that otherwise might have been used by the flow to exert greater shear stress against the streambank soil. Third, the vegetation acts as a buffer against the abrasive effect of transported materials. Fourth, close-growing vegetation can induce sediment deposition causing zones of small velocity at the bank where

shear stresses may become small enough to allow coarse sediment to settle out of the flow. Vegetation also is less expensive than most structural methods and it improves the conditions for wildlife" (Allen 1991:1).

Allen recommends that native plants or naturalized plants already existing in the area should normally be used since they have become adapted to the climate, soils, and other ecological characteristics of the project area. Exotic plants generally do not fare well in these stressful conditions.

Details of the biotechnical approach to erosion control will be discussed in a later report. For now, it should be recognized that it does have its limitations and may be suitable for only a small number of affected historic properties and may represent a temporary rather than a permanent solution.

Research on Biochemical Processes

As previously mentioned, the NRIS considered biochemical processes as a major impact resulting from inundation. At the outset of investigations, previous research (Livingston 1963) had shown that the ionic concentrations of most freshwater reservoirs consist primarily of four cations and three anions, the dominant cations being calcium, sodium magnesium, and potassium, and primary anions consisting of bicarbonate, sulphate, and chloride. The two important variables influencing ionic concentration in a reservoir are climate (evaporation/precipitation) and soil chemistry. Ware (1989:13) provides this summary:

"When evaporation rates are high, dissolved solid concentrations tend also to be high; when precipitation exceeds evaporation, dissolved solids will be more dilute. Other factors affecting water chemistry in reservoirs include the organic content of the soil, the amount of organic material that is inundated in the reservoir, circulation, and water exchange rates within the reservoir, water depth, and thermal stratification, water temperature, and ionic concentrations of inflowing streams and surface runoff" (Sylvester and Seabloom 1964).

Lenihan et al. (1981) determined that the older the reservoir, the more its water chemistry will be determined by stream inflow and precipitation/evaporation rates in the drainage basin. Soil chemistry becomes less and less of a factor as chemicals are leached from inundated soils and as these inundated soils are covered with a sediment blanket.

Another finding from the NRIS is that increased water depths are associated with greater concentrations of sulphate, iron, sodium, magnesium, zinc, hardness, and conductivity. In thermally stratified reservoirs, there may be significant differences in water chemistry among the various temperature zones. Regarding spatial variability, the highest ionic concentration is found in deep waters near the dam with the lowest concentration near the point of

stream inflow. Stream inflow in late spring and summer also tends to be less concentrated than runoff in winter and early spring.

The NRIS authors themselves questioned the overall significance of reservoir water chemistry to cultural resource management. This is because archaeological resources are buried in a soil matrix with its own characteristics. Ware (1989:14) reports that depth within the submerged soil column will largely determine oxygen-reduction (redox) potentials, which in turn will influence the chemistry of the water and the types and varieties of organisms present. Below the highly oxygenated mud-water interface, redox potential increases with depth. Ware (1989:14) notes that in deeply buried anaerobic sediments, preservation conditions should be ideal. Unfortunately, in reservoir drawdown zones, the mud-water interface, the preponderance of biological activity and the consequent breakdown of organic materials is seen. Predicted impacts to archaeological sites under such conditions have been addressed by subsequent research sponsored by WES and performed by Texas A&M University.

Texas A&M's Site Decay Model

Another major research focus within the EIRP has been the study of physical, chemical, and biological processes affecting archaeological sites. Much of this research has been conducted for WES by Texas A&M University. In 1987 a workshop on this topic was held at Texas A&M under the sponsorship of the EIRP. The proceedings of this workshop, in the form of 15 substantive reports, were published by WES as Contract Report EL-89-1.

The focus here will be on the site decay model created by Mathewson (1989:227-238). Mathewson (1989:228) lays the foundation for the model in describing an archaeological site as consisting of "the patterned distribution of artifacts, features, and ecofacts in three-dimensional space and time." It follows then, for a site to be protected or preserved, both its components and their spatial relationships must be preserved. Because the basic scientific data were not available to create a quantitative site decay model, he concentrated on developing a decay matrix that could be used as a "qualitative site decay model." The basic premise behind the matrix is quite simple and is quoted here below along with the referenced table:

"Because the site is an assortment of components having a spatial relationship, changes in the site's environment can accelerate the decay of some components while enhancing the preservation of others. Thus, site protection and preservation projects must be designed to produce the desired beneficial environment. Table 1 lists the general decay effect, in descending order of their significance, of the physical, chemical, and biological factors on an archaeological site."

Figure 2 reproduced here shows the logic-based archaeological component decay and preservation matrix (Mathewson 1989: Figure 1). The matrix

Table 1 Relative Significance of the Site Environment on the Decay of an Archaeological Site (Listed in descending order of significance)	
Most Severe	Wet-Dry and Freeze-Thaw
	Wet Aerobic
	Compression
	Macroorganisms
	Freeze
	Wet Anaerobic
	Acidic Conditions
	Microorganisms
	Movement
	Basic Conditions
	Thaw
Least Severe	Dry

summarizes the effect of postburial change on the preservation or decay of the components of an archaeological site. It is clear that archaeological sites in reservoir drawdown zones sustain the most severe impacts. This exercise confirms the findings of the NRIS study that sites in the fluctuation zone sustain the most severe impacts.

A site decay matrix is a logical first step in the analysis of impacts to a site. In order to create a preservation plan for a historic property, the nature of the impacts must be understood. Mathewson (1989:232-233) describes the process in this way:

“The specific characteristics and components of the site to be protected must be defined. The decay matrix is then consulted to select the desired environmental change to be induced through burial. If the site contains a complex mixture of components, environmental conditions that enhance preservation may be limited to a few alternatives. For example, a site containing both shell and plant remains must be maintained at a neutral pH and either continuously dry or continuously wet and anaerobic for preservationOnce the site components have been defined and the desired environmental conditions for preservation defined, the engineers and scientists must evaluate the site to determine the existing physical, biological, and chemical conditions. Design concepts are then developed and evaluated to determine if the desired environmental change will occur. If the desired conditions can be generated, then the design concept is evaluated with respect to the cost of the proposed burial project. If the design is economically favorable and the environmental change will enhance site preservation, then the project can be implemented.”

		SITE COMPONENTS												
PROCESSES		ANIMAL BONES	SHELL	PLANTS	CHARCOAL	CRYSTALLINE LITHICS	GRANULAR LITHICS	CERAMICS	ARCHAEO. FEATURES	SOIL ATTRIBUTES	METALS	CONTEXT	ISOTOPE CONTENT	TOPOGRAPHY
	ACID ENVIRONMENT	A	A	E	N	N	A	N	N	A	A	N	A	N
	BASIC ENVIRONMENT	E	E	A	N	N	E	N	N	A	A	N	N	N
	DRY (CONT.)	E	E	E	E	N	E	N	N	N	E	N	E	N
	WET ANAEROBIC (CONT.)	E	E	E	A	A	A	A	A	A	A	N	A	A
	COMPRESSION	A	A	A	A	N	N	A	A	A	N	A	N	A
	MOVEMENT	N	N	N	A	N	N	N	A	A	N	A	N	A
	WET-DRY	A	A	A	A	A	A	A	A	A	A	N	A	A
	MICROORGANISMS	A	N	A	A	N	N	N	N	N	A	A	A	N
	MACROORGANISMS	A	A	A	A	N	A	N	A	A	N	A	N	N
	WET AEROBIC	A	A	A	A	N	A	A	A	A	A	N	A	N
	FREEZE-THAW	A	A	A	A	A	A	A	A	A	N	A	A	A
	FREEZE	A	A	A	A	N	A	A	N	E	N	A	E	N
	THAW	N	N	N	N	N	A	N	N	A	N	A	A	N

E - ENHANCES PRESERVATION
 A - ACCELERATES DECAY
 N - NEUTRAL OR NO EFFECT

Figure 2. Matrix showing the conditions that enhance preservation or accelerate decay of archaeological site components (from Mathewson 1989)

This is the heart of the management challenge facing the Corps. The Corps appears to have the conceptual and scientific tools needed to define both site conditions and the nature of the adverse impacts. The next step is the planning and implementation of a scientifically derived protection plan. The fact that this research work unit has been funded is clear evidence of the Corps' willingness to meet this challenge head on. The author is confident that the Corps' response to legally responsible and scientifically sound management recommendations for historic properties in reservoir drawdown zones will be "Essayons," Let us try!

Research on Vandalism

All Corps archaeologists have experienced at some time in their career the peculiar feelings that follow after the discovery of a major episode of vandalism on a significant archaeological site. The sight of fresh potholes on a National Register-eligible site can stimulate a wide variety of reactions amongst cultural resource managers ranging from frustration and impotence to profound anger.

In an effort to prevent such vandalism, or at least minimize its adverse effects, the Corps has sponsored its own research efforts and utilized ongoing research performed for other agencies to combat the problem. One research effort that was presented to the 1991 Workshop participants at Pierre, SD, was undertaken by Dr. James Gramann of Texas A&M's Department of Recreation, Parks, and Tourism Sciences. A quick overview of his recommendations for more effective "indirect management" will be presented here and discussed in greater detail in the examination of the survey questionnaire and the field visits.

Gramann's research interest is the management of visitor behavior. He distinguishes direct versus indirect approaches in controlling visitor behavior. Direct approaches are those "which manage visitor behavior directly through strict enforcement of rules regulating visitors' action" (Gramann 1991:2). This approach is very familiar to the Corps rangers across the United States charged with the enforcement of Title 36. Indirect approaches manage visitor behavior indirectly through the following:

- a. Information and education (e.g., interpretation).
- b. Activity programming (e.g., site adoption programs, violation-reporting programs).
- c. Site design and maintenance (e.g., intentional site burial).

Indirect strategies promote voluntary behavioral change, while direct strategies force behavioral change (Gramann 1991:2).

With the limited manpower at each operating Corps project to directly control visitor behavior, it seems clear that indirect approaches must be incorporated in the Corps' historic preservation program if it hopes to have any chance of steering visitor behavior in a "prosocial" direction. What is prosocial behavior? Gramann (1991:2) defines it as "helping behavior that is not motivated by an expectation of material reward for helping, or threat of probable punishment for not helping."

The reasons why people engage in prosocial rather than antisocial behavior in Gramann's scheme are basically these. They are made aware of harmful consequences for others or for the resources if they do not help by "awareness

of consequences" (AC) messages. Alternatively, they are convinced they have the personal responsibility or capacity to help by "ascription of responsibility" (AR) messages. Conversely, people engage in antisocial behavior when they lack AC messages or feel they have no responsibility to help (lack AR).

Gramman notes four additional reasons for antisocial behavior:

- a. "Unintentional violations" (lack of knowledge).
- b. "Releasor-cue violations" (observing traces of past behavior).
- c. "Status-confirming violation" (peer pressure/group anonymity).
- d. "Willful violations" (e.g., pothunting/criminal intent).

To improve indirect management of visitor behavior, Gramann (1991:4) provides the Corps with the following recommendations for six frequently encountered violations:

Uninformed Violations: Increase visitors' awareness of harmful consequences to society and archaeological record of the site damage (e.g., public education and interpretation).

Responsibility-Denial Violations: Increase visitors' feelings of personal responsibility to help (e.g., site adoption programs).

Unintentional Violations: Increase knowledge of rules among target populations least likely to have this knowledge.

Releasor-Cue Violations: "De-fuse" releasor cues by removing them (i.e., remove evidence of prior vandalism by site rehabilitation or burial) or using educational messages that underscore they are not to be taken as guides to behavior.

Status-Confirming Violations: Promote deviant group's identification with protective models rather than with antisocial models (e.g., through site adoption programs).

Willful Violations: Unlikely to be affected by indirect management; direct management techniques necessary.

Is the Corps doing a good job at its operating projects in controlling visitor behavior toward significant cultural resources? The efforts of a sample of Corps operating projects in the direct and indirect management of visitor behavior will be evaluated in the next section of this report.

5 Current Research

Survey Questionnaire

The questionnaire shown as Figure 3 was prepared by the author following consultation with the original Principal Investigator and EIRP Program Manager. The survey questionnaire was mailed to all Corps Districts (37) and information copies sent to all Corps Divisions (14) on January 25, 1995. The New England Division is counted here as a District.

When the original suspense date of March 15, 1995, was reached, only 16 responses had been received. A second request was sent to the tardy Districts in mid-March, which resulted in the total response by 28 Districts.

Survey Results

Of the 37 Corps Districts queried, 28 Districts (76 percent) responded to the survey questionnaire. Of these, 15 completed the entire questionnaire. The remaining 13 Districts reported no reservoirs to manage. The level of detail provided in the 15 positive responses varied enormously. Some Districts provided a great deal of background information on the reservoirs, including detailed maps of affected historic properties. Other more cursory responses provided little or no detailed information and were therefore of little value. All questionnaire responses appear in Appendix A. Among the Districts that experienced seasonal project drawdowns, there was complete agreement that significant cultural resources were being adversely affected at their projects. The paragraphs below summarize the actual responses made by the 15 Districts that completed the questionnaire.

- Question 1A: (Occurrence of drawdowns)

The 15 Districts that completed the questionnaire displayed great variability in their responses. Districts with numerous reservoirs were generally characterized by differences in the way they were operated, the drawdown area survey coverage at each reservoir, and the way in

SURVEY
TECHNIQUES FOR EFFECTIVE MANAGEMENT
OF
HISTORIC PROPERTIES ON LAKESHORES AND IN DRAWDOWN ZONES

INITIAL QUESTIONS

1. A. WHICH LAKES (RESERVOIRS) IN YOUR DISTRICT EXPERIENCE EITHER PARTIAL OR FULL DRAWDOWNS?
B. DO THESE DRAWDOWNS TAKE PLACE SEASONALLY, ANNUALLY, OR JUST OCCASIONALLY?
C. PLEASE PROVIDE THE RESERVOIR NAME, THE TYPE OF DRAWDOWN, THE FREQUENCY OF DRAWDOWN, AND THE ELEVATION CHANGE (DEPTH OF DRAWDOWN). PHOTOGRAPHS MAY BE ATTACHED TO ILLUSTRATE YOUR RESPONSE.
2. A. HAVE THE AREAS EXPOSED BY THE DRAWDOWN BEEN ADEQUATELY SURVEYED FOR CULTURAL RESOURCES AND THE SITES EVALUATED FOR THE NATIONAL REGISTER?
B. DO THESE DRAWDOWNS AFFECT ARCHAEOLOGICAL SITES WHICH ARE ELIGIBLE OR POTENTIALLY ELIGIBLE FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES OR THE NATIONAL HISTORIC LANDMARKS REGISTRY?
3. DESCRIBE THE NATURE OF THE IMPACTS TO THESE SITES.
A. ARE SITES VANDALIZED DURING PERIODIC OPERATIONAL DRAWDOWNS?
B. ARE SITES BEING ERODED BY FLUCTUATING WATER LEVELS IN THE FLOOD POOL ETC.?
C. ARE SUCH IMPACTS COORDINATED WITH THE STATE HISTORIC PRESERVATION OFFICER (SHPO)?
4. BRIEFLY DESCRIBE CURRENT MANAGEMENT PRACTICES FOR ARCHAEOLOGICAL SITES EXPOSED DURING DRAWDOWNS
A. MONITORING, BANK STABILIZATION EFFORTS, ARCHAEOLOGICAL DATA RECOVERY, ETC.
B. DOES THE OMP OR HISTORIC PRESERVATION MANAGEMENT PLAN (HPMP) FOR THE RESERVOIR ADDRESS IMPACTS TO CULTURAL RESOURCES FROM DRAWDOWNS?
5. IS THERE A PROCEDURE TO LOCATE SITES WHEN THE LAKE IS DRAWN DOWN? IF SO, PLEASE DESCRIBE IT.
A. WHAT IS NOW BEING DONE TO PROTECT THESE SITES?
B. IN YOUR OPINION WHAT SHOULD BE DONE TO PROTECT THESE SITES OR THE INFORMATION THEY CONTAIN?
C. IN YOUR OPINION HOW SERIOUS IS THE PROBLEM?
6. PLEASE NOMINATE AT LEAST ONE CANDIDATE STUDY PROJECT IN YOUR DISTRICT FOR FIELD VISITATION AND MORE DETAILED STUDY.

Figure 3. Survey questionnaire

which operational impacts to recorded sites were coordinated with SHPO and subsequently managed.

- Question 1B: (Drawdown frequency)

Seasonally (greater than once a year)—Five Districts reported seasonal drawdowns, but in four cases these were actually annual drawdowns (Tulsa, Walla Walla, Little Rock, Fort Worth, Mobile); Walla Walla is changing to semiannual drawdowns at some reservoirs.

Annually—14 Districts reported annual drawdowns at some of their reservoirs (Huntington, Sacramento, Pittsburgh, Tulsa, Louisville, Omaha, Nashville, New England, Baltimore, Kansas City, Walla Walla, Fort Worth, Vicksburg, Mobile).

Occasionally (less than once a year)—Five Districts reported occasional operational drawdowns for various reasons, such as aquatic plant control, improvement of fish habitat, etc. (Baltimore, Kansas City, Little Rock, Fort Worth, Mobile).

- Question 1C: (Description of drawdown)

Fifteen Districts provided the requested information; none sent photographs in their initial response.

- Question 2A: (Adequate surveys of drawdown zones and evaluation of sites)

Yes 4 (Louisville, New England, Mobile, Sacramento)

No 6 (Tulsa, Omaha, Nashville, Vicksburg, Pittsburgh, Huntington)

Only some areas 5 (Baltimore, Kansas City, Walla Walla, Little Rock, Fort Worth)

Four Districts reported adequate survey coverage. However, a critical review of their narrative responses reveals that this is true only for the Sacramento District. Sacramento District reported that for the 10 lakes that experienced drawdowns, “all areas exposed by drawdown have been surveyed and evaluated for the National Register.”

In the case of the New England Division, reconnaissance surveys of the drawdown zone have been completed at four of the six projects identified as experiencing drawdowns. In the Louisville District, 13 of their 16 lakes have been 100-percent surveyed in the zone between seasonal and drawdown pools. Two of the three remaining lakes have been partially surveyed as a result of these surveys. None of the many sites identified as a result of these surveys have been evaluated for

eligibility to the National Register. Mobile District reported that they have completed their surveys of the drawdown zone, but that only some sites have been evaluated.

- Question 2B: (Adverse effects to eligible sites)

Yes 10 (Tulsa, Omaha, Nashville, New England, Little Rock, Fort Worth, Vicksburg, Mobile, Sacramento, Huntington)

No 0

Perhaps (sites unevaluated) 5 (Louisville, Baltimore, Kansas City, Mobile, Pittsburgh)

Ten Districts reported that historic properties (National Register-eligible) were being adversely affected by erosion and vandalism. Five other Districts had potentially significant sites that had not been formally evaluated for the Register but were being adversely affected. This response should really be regarded as 100-percent agreement on adverse effects.

- Question 3A: (Vandalization of archaeological sites)

Yes 14

No 1 (Baltimore)

With the exception of the Baltimore District, all responding Districts reported vandalism and surface collection from archaeological sites located in their reservoir drawdown zones. Baltimore District chose to respond in the following manner:

"Due to the fact that the drawdown areas have not been surveyed, the nature of the impacts cannot be assessed."

It is not unreasonable to assume that archaeological sites are also being vandalized here as well.

- Question 3B: (Erosion from fluctuating water levels)

Yes 11 (Tulsa, Nashville, Kansas City, Walla Walla, Little Rock, Fort Worth, Vicksburg, Mobile, Pittsburgh, Sacramento, Huntington)

No 2 (Omaha, New England)

Unknown 2 (Louisville, Baltimore)

The two negative responses require some explanation. In the case of the New England Division, the negative response actually refers to the

Ball Mountain Lake project. Erosional impacts were reported for Mansfield Hollow Lake. This was confirmed during the field visit to Mansfield Hollow Lake. The negative response from the Omaha District "not to any great extent" reflects an obvious misunderstanding of the question. Severe erosional impacts are occurring to the Missouri River reservoirs, which have been documented by the Missouri River Division and observed during the 1991 Site Protection Workshop.

- Question 3C: (SHPO coordination on drawdown impacts)

Yes 6 (Louisville, New England, Kansas City, Mobile, Sacramento, Huntington)

No 3 (Omaha, Vicksburg, Baltimore)

Sometimes 6 (Tulsa, Nashville, Walla Walla, Little Rock, Fort Worth, Pittsburgh)

The mixed responses to this question reflect the confusion of Corps managers regarding their Section 106 (NHPA) responsibilities for sites located in the drawdown zone that have not been formally evaluated for their National Register eligibility. This is certainly the case for the Vicksburg District response as the author discovered during a field visit to Grenada Lake. In the case of the Omaha District, it reported SHPO awareness of the problem, but no formal Section 106 coordination for each eroding site.

- Question 4A: (Management practices during drawdowns)

Inventory/Evaluation 4 (Tulsa, Omaha, Little Rock, Huntington)

Monitoring/Ranger Patrols 8 (Tulsa, Nashville, New England, Walla Walla, Little Rock, Fort Worth, Mobile, Sacramento)

Stabilization/Protection 5 (Tulsa, Louisville, Nashville, Little Rock, Fort Worth)

Data Recovery 4 (Tulsa, Louisville, Little Rock, Sacramento)

Nothing/Neglect 3 (Baltimore, Vicksburg, Pittsburgh)

Responses to this question reflect the varying levels of compliance for individual lakes within a given District and the varying levels of compliance of each District within the Corps. The negative responses require clarification. The response from the Pittsburgh District was that "we have no formal management practices for drawdown zone sites." This is a reflection of the fact that the Pittsburgh District has no archaeologist on staff at this time. During a field visit to Allegheny Reservoir, the author learned that Forest Service archaeologists are

attempting to monitor erosion and mitigate adverse effects at this project.

The Baltimore District's response is most revealing and clearly highlights the most central problem: "Currently, there are no mandated practices for the treatment of archaeological sites exposed during draw-downs." ER 1130-2-438 may need to be modified to ensure that Districts are fully aware of their legal responsibilities toward sites located in the drawdown zone.

The Vicksburg District's response "none" is a reflection that there are no archaeologists in the Operations Division in that District and that "interference" from the archaeologists in the Planning Division is not welcome.

- Question 4B: (OMP/HPMP treatment of impacts)

Yes 4 (Louisville, Mobile, Sacramento, Huntington)

No 9 (Omaha, Nashville, New England, Baltimore, Kansas City, Walla Walla, Fort Worth, Vicksburg, Pittsburgh)

In process 2 (Tulsa, Little Rock)

There are two compliance problems reflected in these responses. First, based on discussions with Corps archaeologists at the Society for American Archaeology (SAA) meeting, most Districts are behind in the production of the Historic Property Management Plans (HPMPs) required by ER 1130-2-438. Second, there appears to be an insufficient emphasis placed on the drawdown zones in the HPMPs that have been created. The periodic Operations ERGO reviews may make note of the absence of HPMPs; but with no substantive penalty for lack of compliance, this situation will change slowly, if at all. This last observation is based on the author's personal experience with the five Southwestern Division Districts while he served as acting SWD archaeologist during 1993 and 1994.

- Question 5A: (How are sites protected during drawdowns?)

Surveys 3 (Omaha, Nashville, Little Rock)

Stabilization 1 (Tulsa)

Data Recovery 0

Monitoring/Ranger Patrols 9 (Nashville, New England, Kansas City, Walla Walla, Little Rock, Fort Worth, Mobile, Sacramento, Huntington)

Neglect (inadequate funds/manpower) 5 (Louisville, Omaha, Baltimore, Vicksburg, Pittsburgh)

These responses reflect the fact that most Districts are using a number of different procedures to protect sites during drawdowns. The totally negative response for data recovery is surprising, but probably reflects management's awareness of the high cost of archaeological excavation. The responses indicating neglect are certainly troubling, but accurately reflect a manpower/funding problem that is widespread throughout the Corps. The following response provides a clear example of these difficulties:

"Because of time and monetary constraints, along with otherwise heavy workloads, virtually nothing is now being done in the Louisville District to protect the sites identified during the drawdown (shoreline) surveys."

- Question 5B: (What should be done?)

Sample comments from the 15 responding Districts included the following:

- 1-Greater commitment of time and money on part of COE management.
- 2-Complete site inventory (survey and testing for NRHP).
- 3-Schedule data recovery on significant sites during drawdowns.
- 4-Increase ranger patrols during drawdowns.
- 5-Temporary closure of culturally sensitive areas.
- 6-Map and monitor archaeological sites.
- 7-Develop comprehensive program including survey, testing, monitoring and data recovery/stabilization on the most significant sites.
- 8-Preservation/stabilization of significant sites should be the preferred alternative.

- Question 5C: (How serious is the drawdown problem?)

Very 7 (Tulsa, Walla Walla, Little Rock, Fort Worth, Vicksburg, Mobile, Huntington)

Moderate 4 (Louisville, Nashville, New England, Huntington)

Not very (some projects) 2 (Kansas City, Sacramento)

Too late (site integrity lost) 3 (Louisville, Kansas City (some projects), Pittsburgh)

These mixed responses reflect both varying levels of compliance and of awareness of management responsibilities. The Pittsburgh District provided a most measured thoughtful response that is quoted here in its entirety:

"In our opinion, the problem is very serious. At our operating reservoirs, shoreline and drawdown erosion/exposure with its attendant surface collection/vandalism is probably more detrimental to archeological sites than all other management practices combined. Since most of our reservoirs were constructed prior to the Reservoir Salvage Act, there was little or no pre-impoundment archeological survey work. Subsequently, this zone has exposed scores of sites whose numbers would probably increase significantly if a systematic inventory were undertaken. In addition to prehistoric sites, there is also the historical archeological component to consider where farmsteads and communities were razed during reservoir construction.

The seriousness of this situation is compounded by the general lack of institutional recognition of operational impacts to historic sites and by the Corps budgeting process which prioritizes justification of O&M funds to construction over management-related impacts. With recent budgetary constraints we have not had cultural resources funds approved for anything but construction support, and in FY 95 we had no O&M cultural resource monies whatsoever approved."

- Question 6: (Nomination of projects for field visitation)

The 15 Districts that completed the questionnaire nominated 24 projects for field visitation and follow-up study as shown in the following list.

Projects Proposed by Districts for Field Visitation		
District	Completed Questionnaire (y/n)	Proposed Project for Field Visit
Omaha	yes	Van Hook Arm of Lake Sakakawey Garrison, ND
New England	yes	Mansfield Hollow Lake, CT Ball Mountain Lake, VT
Honolulu	no	N/A
Norfolk	no	N/A
Louisville	yes	Barren River Lake, KY
Nashville	yes	Lake Barkely, KY
Jacksonville	no	N/A
Savannah	no	N/A
Chicago	no	N/A
Charleston	no	N/A
(Continued)		

(Concluded)		
District	Completed Questionnaire (y/n)	Proposed Project for Field Visit
Little Rock	yes	Nimrod Lake, AR
MRD	no	Sent Archaeological and Hydraulic information
Baltimore	yes	Curwensville, PA Whitney Point, NY Sayers Dam, PA
Pittsburgh	yes	Mosquito Creek, OH Shenango River, PA Kinzua Dam and Allegheny Reservoir, PA
Kansas City	yes	Harlan County Lake, NE
Walla Walla	yes	Dworshak Reservoir, ID
Memphis	no	N/A
New York	no	N/A
Fort Worth	yes	Wright Patman Lake, TX
New Orleans	no	N/A
Vicksburg	yes	Lake Ouachita, AR Grenada Lake, MS
Mobile	yes	Allatoona Lake, GA West Point Lake, GA
Detroit	no	N/A
San Francisco	no	N/A
Sacramento	yes	Lake Kaweah, CA
Alaska	no	N/A
Huntington	yes	Bluestone Reservoir, WV
Galveston	no	N/A
Tulsa	yes	Lake Eufala, OK Lake Texoma, OK (Haley Site) R. S. Kerr Lake, OK (Hickory Ridge Site)

The completed questionnaires clearly show that at most Corps reservoirs, operational impacts to historic properties from seasonal drawdowns are indeed a serious ongoing problem. Prehistoric and historic archaeological sites are the major class of historic properties that are being impacted by fluctuating water levels in Corps reservoirs. A few Districts reported that the problem was no longer serious only because a majority of the sites in their lakes' drawdown zones were eroded away or so heavily vandalized that the sites had lost sufficient integrity to qualify for National Register eligibility.

The responses to the questionnaire clearly show that here is a problem that is serious, widespread, producing adverse effects to significant sites, but with no clear consensus on how to deal with it.

Discussion of the Districts' Responses

A critical review of the individual questionnaires and the background information provided by each District revealed several disturbing trends. First, the drawdown zones at most Corps reservoirs have not been adequately surveyed for cultural resources. Second, most sites that have been identified in follow-up surveys during drawdowns or, rarely, by surveys conducted prior to impoundment, have not been evaluated for National Register eligibility. Third, of the known historic properties determined eligible for the National Register, only a few have received adequate mitigation of the adverse effect caused by periodic inundation. Fourth, most project managers at Corps reservoirs and some District archaeologists are uncertain regarding their responsibilities under the law for sites located in drawdown zones. Fifth, in the rare cases where historic properties have been identified and responsibilities toward these sites have been clearly delineated in Memoranda of Agreement with SHPO and Advisory Council, the Corps, in general, is not adequately protecting these sites from erosion and vandalism.

In addition to reviewing the written responses to the questionnaire, additional feedback was requested from the Corps archaeologists who attended the 1995 Society for American Archaeology Annual Meeting in Minneapolis, MN. In most cases, these archaeologists were the same individuals who had responded to the questionnaire. The focus of group discussion at the Corps archaeologists meeting was the proper management and mitigation of impacts to sites located in drawdown zones.

Following a status report on the work unit, consensus was quickly reached that, ideally, all reservoir lakeshores and drawdown zones should have the following treatment:

- a. Complete inventory (including evaluation of sites for the National Register).
- b. Stabilization/protection of the significant sites/historic properties where this is technically feasible.
- c. Mitigation of adverse impacts through data recovery where in situ preservation is not a feasible long-term alternative.

The contrast between this clear level consensus among the Corps' cultural resource specialists and the Districts' responses to the questionnaire raises the issue of why such profound discrepancies should exist. The answer appears to lie in the complex web encompassing the Corps' budgetary policy toward cultural resources, a real manpower shortage, and an apparent institutional reluctance to take control of a problem that does not appear to be part of the Corps' "Mission." If this is true, it will have to be addressed at a policy level and not simply as a technical or scientific issue.

High-profile, politically sensitive mitigation projects on sites in drawdown zones have been funded by Corps Districts, and these success stories are widely publicized. In general, however, funding requests for routine inventory, evaluation, and mitigation of sites in drawdown areas too often fall prey to the Corps annual budgeting procedure. As described by a representative from the Operations Division, Headquarters, U.S. Army Corps of Engineers (HQUSACE), who participated in the Minneapolis SAA meeting, "Understanding the O&M budget matrix and getting into the baseline level is the only sure way of securing funding."

As described in the Corps EC 11-2-166 (dated 31 March 1992), these are the funding levels:

Baseline

Annual costs to manage historical, archaeological, and cultural resources activities, and perform historic property resource surveys and testing as required by law to enable accomplishment of other newly initiated and ongoing baseline activities include necessary coordination with other agencies, State Historic Preservation Offices (SHPO), and the Advisory Council on Historic Preservation (ACHP).

Nondeferrable in budget year

Nonannual costs which cannot be deferred to manage historical, archaeological, and cultural resource activities, and for initial historic property resources surveys and testing of identified sites including necessary coordination with other agencies, State Historical Preservation Offices (SHPO), and the Advisory Council on Historic Preservation (ACHP).

Deferrable in budget year

Nonannual costs which can be deferred to manage historical, archaeological and cultural resources activities, and for initial historic property resource surveys and testing of identified sites including necessary coordination with other agencies, State Historical Preservation Offices (SHPO), and the Advisory Council on Historic Preservation (ACHP).

The Corps archaeologists who participated in the 1995 Minneapolis meeting saw clearly, perhaps for the first time, that to effectively manage impacts that occur annually, every time a reservoir is drawn down, the Corps must change the way it does business. To effectively manage sites in reservoir drawdown zones, each District must create baseline level funding that can be counted on every year. Until every site is identified, evaluated, and the adverse effects to historic properties mitigated through data recovery or site stabilization, a baseline funding category for drawdown site management must

be part of the annual O&M budget. If the Corps categorizes work in the drawdown zones as deferrable until some later date, it stands to lose even more of the nation's cultural patrimony. Hundreds, perhaps thousands, of archaeological sites have already been destroyed. If the Corps is genuinely committed to preserving the remainder of these sites, it must begin to see drawdown site management as part of the annual cost of doing business.

Field Visit Selection Criteria

Due to funding constraints during the first year of the work unit, projects that the author had already visited during his tenure as Little Rock District archaeologist were eliminated from consideration for follow-up site visits. These included Lake Nimrod (Little Rock District) and Lake Ouachita (Vicksburg District) both in Arkansas. Because the author had visited several Missouri River reservoirs (Lake Oahe, Lake Sharpe, and Lake Francis Case) during the 1991 Workshop on Site Preservation in Pierre, SD, additional site visits to this area were also not undertaken. Also, the Corps' Missouri River Division sent a considerable volume of background information on cultural resource management at their projects that was extremely helpful to the author, but rendered site visits unnecessary.

Projects that did not identify specific historic properties that had been determined eligible for listing in the National Register were not eliminated, but were relegated to secondary importance for the selection of follow-up case studies in the next fiscal year. In cases where the information provided on the survey questionnaire was inadequate or unclear regarding the presence of historic properties, the author interviewed the District archaeologist or project cultural resource coordinator by telephone. Examples of this include Lake Sakakawey in North Dakota and Lake Kaweah in California.

Where Districts nominated multiple reservoirs, an effort was made to select one, or at most two, with known historic properties that were being impacted by cyclic drawdown and exposure. Two reservoirs in the New England Division were visited since they were in quite different environments and both had significant cultural resources in their respective drawdown zones. An effort was also made to reduce redundant data by not visiting projects in the same geographic region where the same types of management practices could be expected. Photos 1-35 depict some of the field visits.

Description of Field Visits

Grenada Lake in Mississippi was visited in late April prior to the Corps meeting at the SAA in early May. During the period from early June through mid-August, eight additional reservoirs with significant sites located in the drawdown zones were visited. In chronological order, they included the following:

Wright Patman Lake, Texas
Lake Eufala, Oklahoma
Lake Barkley, Tennessee and Kentucky
Barren River Lake, Kentucky
Bluestone Lake, West Virginia
Allegheny Lake, Pennsylvania and New York
Mansfield Hollow Lake, Connecticut
Ball Mountain Lake, Vermont

Plans were made during late August to visit three additional reservoirs in the North Pacific Division early in FY96 (October 1995). These visits would be made as part of the ongoing research project for the Corps North Pacific Division.

Prior to visiting the selected reservoirs, a memorandum was prepared and sent to the project managers. This was done subsequent to extensive telephonic coordination with the District archaeologist or District point of contact for cultural resource management. Figure 4 reproduced on the next page illustrates the approach taken with these field visits. Detailed discussions on these site visits appear in the subsequent sections of this report.

MEMORANDUM FOR SEE DISTRIBUTION

DATE: 7/10/95

SUBJECT: Initial Field Visits/Interviews for Research Work Unit 32881 "Techniques for Effective Management of Historic Properties on Lakeshores and in Drawdown Zones"

1. The Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station (WES), is investigating impacts to archaeological sites which occur as a result of reservoir drawdowns. To aid Corps archaeologists in more effectively managing these cultural resources, the WES has undertaken a research program with the following goals:

a. Better delineation of the problem, especially in terms of methods for improved impact assessment and the quantification of effects.

b. Techniques for efficient identification and evaluation of historic properties (those eligible for the National Register of Historic Places) affected by drawdowns.

c. Guidelines for the treatment of such properties, including monitoring, data recovery, and preservation options.

2. Based on your District's responses to our questionnaire and the recommendation of your District Archaeologist your project has been selected for an initial site visit. This visit will consist of two parts. First, a short meeting will be held in the resident office during which time your current management practices will be discussed and the potential for a more detailed case study focusing on a specific site area during the project's seasonal drawdown will be assessed. You or your cultural resource coordinator should plan to attend. Second, a visit to areas where known historic properties are being affected will be attempted. Your District Archaeologist will be participating in this field visit.

3. The second round of field visits is scheduled for the period of July 31-August 11:

Bluestone Lake, Hinton, WV - 0900 on 1 August 1995

Allegheny Reservoir, Warren, PA - 0900 on 3 August 1995

Mansfield Hollow Lake, Mansfield Cent., CT - 0900 on 7 August 1995

Ball Mountain Lake, Jamaica, VT - 0900 on 9 August 1995

4. Your cooperation and assistance during the field visit will be greatly appreciated. Because I will be on official travel during the week of July 24-28 all questions you might have about the work unit and field visits should be directed to my supervisor, Mr. Roger Hamilton, Chief, Resource Analysis Branch, Environmental Laboratory, at 601/634-3724. Other questions concerning the field visits should be directed to your District Archaeologist.

Robert A. Dunn
Research Archaeologist
CEWES-EN-R

Figure 4. Memorandum regarding field visits

6 Field Observation of Management Practices

Grenada Lake, Mississippi

Reservoir description

Grenada Lake is an essential part of a comprehensive plan for flood control in the Yazoo River Basin in northern Mississippi. The dam is located on the Yalobusha River about 3 miles¹ northeast of Grenada, MS. It is earth filled and measures a little over 2.6 miles in length. The top of the dam is at 256 ft NGVD. Operation of the dam began in January 1954. Since its creation, flooding has been reduced around the cities of Greenwood, Yazoo City, Belzoni, and other smaller communities. The Recreation pool is reached at elevation 215 ft NGVD, which is usually the approximate lake elevation during the summer months. It contains 35,820 acres of water and approximately 148 shoreline miles.

The minimum or conservation pool contains 9,800 acres at 193 ft NGVD, which is usually the approximate lake elevation during the winter months and contains 9,800 acres of water. There are 54 miles of shoreline at this elevation.

The maximum or flood control pool is reached at 231 ft NGVD and contains 64,000 acres of water. Water above this elevation will flow over the overflow spillway. There are 282 miles of shoreline at this elevation. The drawdown zone is that area between elevation 231 and 193 ft NGVD (1992 Project Brochure).

¹ A table of factors for converting non-SI units of measurement to SI units is presented on page viii.

Status of CRM

The project was visited on April 28, 1995. The author interviewed the senior ranger designated as the cultural resource coordinator and the lake manager. Prior to the visit, there was extensive coordination with the two Vicksburg District archaeologists in the Planning Division. Neither District archaeologist attended the onsite meeting. Following the meeting, the author inspected several portions of the drawdown zone on the western margin of the reservoir. No evidence of pothunting was observed in one area where sites were recorded. However, pool elevation on that day was at 218 ft, and the majority of these sites are located below that elevation.

There are numerous archaeological sites recorded in the drawdown zone. Most of these were recorded after the creation of the lake in 1954. There have been several follow-up surveys of the drawdown zone since the creation of the lake. None of these sites have been formally evaluated for the National Register and coordination undertaken with the Mississippi SHPO. Consequently, their status as historic properties is uncertain.

There is a dense concentration of prehistoric archaeological sites opposite the visitor center near the Skuna-Turkey Public Use Area, the Hugh White State Park, and the Choctaw Public Use Area. Above the drawdown zone on Corps fee land, there are Civil War earthworks that are listed on the National Register. There is minimal disturbance to the Civil War fortifications from lake visitors. Surface collection on archaeological sites exposed by the winter drawdown is a continuing problem.

There is no HPMP as required by ER 1130-2-438. There is a brief discussion of cultural resources in the project operational management plan (OMP). Major emphasis is now put on archaeological surveys for compliance with Section 106 (NHPA) for timber sales on fee land above the drawdown zone. There has been enforcement of the Corps current policy on the use of metal detectors. There appears to be minimal contact between project personnel and the archaeologists in the Planning Division at the District office. At this time, contracting for archaeological surveys of fee land above the drawdown zone is done by the resident staff, not the archaeologists in the District.

Impacts to historic properties

Shoreline erosion of prehistoric archaeological sites and heavy surface collection from exposed sites during drawdowns are the major impacts. Because the numerous prehistoric sites in the drawdown zone have not been tested for the National Register, it is uncertain whether significant historic properties are being impacted. Ranger patrols are occasionally undertaken to deter surface collectors, but there are no ARPA prosecutions or citations under Title 36 on record at the project office. There is reported damage to sites from the use of all-terrain vehicles used on the exposed mud flats during drawdowns. There

is no record of coordination with the Mississippi SHPO on impacts to sites in the drawdown zone. There has been no attempt to mitigate adverse impacts through site stabilization or archaeological data recovery. The difficulty of getting heavy equipment on to the mud flats during drawdowns is the explanation given for the absence of active site stabilization/preservation efforts.

Wright Patman Lake, Texas

Reservoir description

Wright Patman Lake and Dam are integral parts of the comprehensive plan for flood control in the Red River Basin of East Texas. The project was authorized as Texarkana Dam and Reservoir by the Flood Control Act of July 24, 1946. It was later known as Lake Texarkana. In 1973, the name was changed to honor Congressman Wright Patman of the First Congressional District of Texas.

The dam is located 9 miles southwest of Texarkana, TX. It is designed for retention of floodwater of the Sulphur River. Elevation of the conservation pool is 220.6 ft NGVD. Elevation of the flood control pool is 259.5 ft NGVD. At conservation pool elevation, the surface area of the lake is 20,300 acres. At maximum flood pool elevation, this increases to 119,700 acres. The normal summer season elevation is 227.5 ft. There is an annual winter drawdown to 220.5 ft beginning in November and lasting until April. This drawdown exposes about 13,000 acres.

Status of CRM

According to the Fort Worth District Operations Division archaeologist who attended the onsite meeting on June 13, 1995, the eastern one-third of the reservoir has been adequately surveyed for cultural resources. Sample surveys have been conducted all around the reservoir. Archaeological sites in the drawdown zone are being adversely affected by surface collectors, pothunters, and by erosion of the sand clay soil.

There have been several ARPA prosecutions and a number of Title 36 citations issued to individuals to halt the vandalism of these sites. While the Texas SHPO is aware of the pothunting problem at Wright Patman, there is no individual coordination of site impacts by District personnel. The cultural resource coordinator for Wright Patman has, on his own initiative, installed electronic intrusion detection devices on several Caddo burial sites, which have become the targets of pothunters. An HPMP is in preparation that will use GPS to tie in all recorded site locations to the District's GIS system.

Ranger patrols are done regularly when the lake is drawn down. At present, there are four rangers to cover the entire 103,000-acre project. There is

a genuine interest and concern for the preservation of sites on the part of the lake manager and his staff. The ranger designated as the cultural resources coordinator is doing an exceptional job given funding limitations.

Impacts to historic properties

Erosion and vandalism are the major impacts observed on sites in the drawdown zone. Several site testing projects have shown that there are a number of very significant archaeological sites at this project. Following testing and partial data recovery, there was a major protection and stabilization project on the Knight's Bluff site (41CS14), a National Register-eligible Caddo site, in 1976. This work was conducted for the New Orleans District, who had jurisdiction at the time.

Another significant prehistoric site that is being adversely affected is the Armstrong Landing Site (41CS37). This site has experienced severe pothunting. District and project staff are now taking steps to curtail this illegal activity through ARPA enforcement, electronic surveillance, and frequent ranger patrols. In addition, Wright Patman Lake has entered into a cooperative stewardship program with River Basins Institute, Inc., of Atlanta, TX, to identify other areas of cultural disturbance, publicize results, and make recommendations for mitigation of adverse effect to the historic properties at Wright Patman.

The major management objective is to complete survey and testing in order to arrive at a complete list of the historic properties that are present. This work is now on hold due to funding restrictions. The District appears committed to stewardship of the resources it manages.

Eufala Lake, Oklahoma

Reservoir description

Eufala Lake in eastern Oklahoma is one of the largest reservoirs in the Corps of Engineers project inventory. It is an important component of the comprehensive flood control plan for the Arkansas River basin and a major storage reservoir for the McClellan-Kerr Arkansas River Navigation System. It impounds the Canadian River in an area rich in archaeological resources. The project was visited on June 14-15, 1995. At the time of the site visit, the reservoir was in a surcharge condition with a pool elevation at 597.3 ft NGVD.

The reservoir experiences a partial annual drawdown during the winter months. Over the course of a month, it is brought down from the normal conservation pool elevation of 587 to 585 ft. This drawdown exposes numerous archaeological sites.

Status of CRM

There have been numerous small sample inventory surveys of the enormous shoreline around Eufala Lake. Whether these surveys constitute an adequate inventory is open to question. Many of the archaeological sites recorded in the drawdown zone have already been severely impacted by erosion. One site stabilization project at Eufala was recorded in the WES film entitled "Engineering Solutions for Heritage Preservation." The film segment on Eufala deals with the use of vegetation plantings in a high-energy environment to control shoreline erosion. There have been other stabilization projects at Eufala that are briefly discussed in the next section.

There have been few formal testing projects on drawdown sites since the majority of sites observed each year have been heavily impacted by erosion and intense surface collection by local amateurs. The District has opted to spend its limited CRM funding for Eufala on the Section 106 coordination of project specific impacts near public use areas and the inventory of upland fee lands rather than on evaluation of shoreline sites that have already been heavily impacted. Project personnel keep up a computerized database on surveys conducted for real estate projects and regulatory permit actions on fee lands above the flood pool. They plan to have an operating GIS system at Eufala in the near future. However, this system will focus on fee land above the flood pool.

At this time, there is no structured management program for sites in the drawdown zone. When project personnel are notified by the public or by concerned archaeologists that human remains are being exposed, they contact the District archaeologists in Tulsa for emergency data recovery. There are no regular ranger patrols during the annual drawdown. There have been no ARPA prosecutions or Title 36 citations issued for illegal digging and collecting. While there is a discussion of cultural resources in the project OMP, there is no HPMP at this time.

Impacts to historic properties

The dual problems of erosion and vandalism appear to be particularly severe at Eufala Lake. The total number of historic properties meeting National Register criteria is unknown since there have been so few sites tested. One archaeological site with human burials has been protected by a rock berm near the Belle Starr park. Another site protection project, incorporating anchored telephone poles, is located near the Fountainhead State Park. Another significant site in the vicinity of Eufala Cove has been destroyed by vandals and the effects of high water.

With only two rangers for this enormous project and no baseline funding for work in the drawdown zone, there is little attention paid to sites in the drawdown zone. One disturbing aspect of the CRM program at Eufala is that the project staff sincerely believes that sites in the drawdown zone are mostly

destroyed, which in fact may be the case. Consequently, they are reluctant to spend either time or manpower on the problem. It is well known that pot-hunters and collectors are scavenging the sites in the drawdown zone. Yet, there is only a token effort to curtail this kind of illegal activity. The District archaeologists are aware of the problem, but they are stretched to the breaking point by 33 other projects with a host of similar problems. In their defense, many of the problems at Eufala Lake have been successfully dealt with at Wister Lake and other projects in the Tulsa District.

Lake Barkley, Tennessee and Kentucky

Reservoir description

At maximum flood pool elevation, Lake Barkley has more than 93,000 surface acres and a shoreline measuring 1,004 miles in length. Straddling the Tennessee-Kentucky state line, this beautiful project, along with the Tennessee Valley Authority's Kentucky Lake, is part of the Land Between the Lakes National Recreation Area. Lake Barkley is a key part of the coordinated plan for development of the water resources of the Cumberland River and its tributaries, and of the overall plan for flood control and other purposes in the Ohio River Basin. The project visitors brochure notes the following:

"Barkley Lock and Dam, in conjunction with Cheatham Lock and Dam, enables river vessels to travel easily from Nashville, Tennessee to the mouth of the Cumberland River and into the Ohio River. The river traffic moves over a waterway with a minimum depth of 9 feet...Other important benefits of harnessing the water resources are power generation and flood control...From spring to fall the lake is operated within a five-foot zone, utilizing 259,000 acre feet of storage for power production and reserving 1,213,000 acre-feet for regulation of flood flows. During the flood season, normally December through March, the upper portion of the lake stores flood waters. Excess water is used for power production, or it is released through spillway gates after the danger is past."

Normal pool operation during the summer and winter seasons, incorporating a power drawdown, is from 359 to 354 ft. The minimum elevation of 346 ft is reached in November and December only in advance of floods. For purposes of this study then, the drawdown zone at Lake Barkley extends from minimum conservation pool elevation 354 ft to maximum flood pool elevation 375 ft. The project experienced a major drawdown during a severe drought in 1987.

Status of CRM

The Lake Barkley project was visited on June 20, 1995. The author interviewed the Nashville District archaeologist and the ranger designated as the cultural resource coordinator. Following that meeting, a number of

archaeological sites recently recorded within the drawdown zone were visited in the vicinity of the Cross Creeks National Wildlife Refuge, Corps land now leased and managed by the U.S. Fish and Wildlife Service.

There have been several small sample surveys of the drawdown zone sponsored by the Nashville District. These surveys have recorded about 60 archaeological sites that have never been formally evaluated for National Register eligibility. A great deal more inventory work needs to be done before the District will have a complete inventory of its historic properties. The Waylon site located below the Dam, but on Corps land, is now listed on the National Register of Historic Places.

There was little erosion of archaeological sites during the first 20 years of lake operation, but the problem is now beginning to get worse. One site has been protected by riprap in the last several years. Shoreline sites are heavily collected by boaters during the annual fall drawdown. There have been no ARPA prosecutions and no Title 36 citations according to the cultural resource coordinator. The difficulty of catching people in the act is the reason given. There is no effort by project staff to coordinate with SHPO on the impacts of erosion and vandalism to individual sites. The District archaeologist has coordinated with SHPO when major sites are involved such as the one ripped a few years ago. An HPMP for Lake Barkley is in preparation. More survey and testing of sites are scheduled in the drawdown zone. The District would prefer to preserve significant sites in situ if possible rather than conduct expensive data recovery projects.

Impacts to historic properties

The problems of erosion and vandalism at Lake Barkley do not appear as severe here as observed in the Corps Southwestern Division. The lack of site testing information on the recorded sites makes it difficult to state how many significant sites are being adversely affected. At the present time, there are a dozen or so significant prehistoric sites, some with human burials, which are being eroded and exposed to vandalism. As the site inventory is completed, greater efforts to enforce existing site protection laws and regulations will surely follow. The District is aware of the problem and taking steps to rectify it. However, it is a slow process.

Barren River Lake, Kentucky

Reservoir description

Barren River Lake is located in south-central Kentucky, approximately 95 miles south of Louisville. The dam is on the Barren River approximately 79 river miles upstream of its juncture with the Green River. The project was designed and built and is operated by Louisville District to aid in reducing

flooding and flood damage along the Barren, Green, and Ohio rivers. Construction began in 1960, and the project became operational in 1964. The project visitors brochure provides this description of the lake:

"During the fall and winter months, when excessive rainfall is likely, the lake is kept at a relatively low level. Should heavy rains occur, the surface water runoff can be stored in the lake until the swollen streams and rivers below the dam have receded and are capable of handling release of this water without danger to lives and property nearby...The name "Barren" stems from the days of the early pioneers who called the area "The Barrens." Vegetation on the land was periodically burned off by the Indians to provide the grasslands that were attractive to grazing buffalo, and thus this area was without trees and appeared to be barren. There were several large Indian settlements near Barren River as evidenced by the archaeological sites found."

Maximum flood pool elevation is 590 ft NGVD. Minimum pool elevation is 525 ft. Normal pool levels for most of the year is at 552 ft. The reservoir experiences a 27-ft drawdown annually. From mid-September to mid-October the lake is gradually drawn down 2 ft. After December 1, the lake is drawn down an additional 25 ft. At this time, numerous archaeological sites are exposed.

Status of CRM

Barren River Lake was visited by the author on June 22, 1995. The project has been subject to a large-scale preimpoundment survey and several follow-up surveys of the drawdown zone since its creation. The detailed well-written Historic Properties Management Plan, prepared by the District archaeologist, provides the following summary:

"The permanent pool, consisting of 4,340 acres has been inventoried for historic properties. A shoreline reconnaissance for historic properties in the 5,660 acres of fluctuating shoreline has been accomplished. As a result of these surveys, 167 archaeological sites 230 areal components have been documented...Eight sites with 15 areal components have been evaluated by archaeological testing and/or limited data recovery. One of the evaluated sites, 15BN21, has been partially excavated by large scale data recovery. This mitigation was conducted in response to the impending loss of the significant resources prior to the impoundment of the Barren River...No historic properties at Barren River Lake are currently listed on the National Register. At one time, prior to 1979, sites 15BN349, 15BN384N, 15BN384S, and 15BN390 were submitted for nomination to the National Register as an archeological district. A Mississippian stone box cemetery, site 15AL329A, was also submitted for nomination. These sites were never listed with the NR due to changes in regulations which required the re-submission of revised nomination forms."

SHPO coordination of the HPMP is ongoing, and steps are underway to mitigate adverse effects to a number of the significant sites in the drawdown zone. One site in particular, the Jewell Mound Site, is a potential case study for the second phase of this work unit. The goals for future work at Barren River include the following:

- a. Complete survey of 10,108 acres of backshore and uplands.
- b. Test 159 sites for National Register eligibility; 76 of these are inundated seasonally and must be evaluated during the winter drawdown period of the lake.
- c. Nominate to the National Register all sites that can still meet the criteria of eligibility.
- d. Enact protective measures in order to mitigate adverse impacts to sites listed to, or eligible for listing to, the National Register.

Impacts to historic properties

Following a meeting at the project office with the Louisville District archaeologist and the ranger designated as cultural resource coordinator, the author inspected several archaeological sites in the vicinity of Barren River State Park that are being severely eroded. One of these sites, containing late prehistoric stone box burials, underwent emergency data recovery by the District's archaeologists shortly after the author's visit. Because of the large annual drawdown, erosion is a serious threat to the historic properties in the drawdown zone.

While there is some surface collection from exposed sites, serious pothunting, such as observed in Texas and Oklahoma, does not appear to be a major threat. No ARPA prosecutions or Title 36 citations have been issued. The District has an excellent plan to prevent or mitigate adverse effects to the significant sites at Barren River. If sufficient funds and manpower are made available to implement this plan, this small project could well serve as a model for CRM throughout the Corps of Engineers.

At the time this is being written, a follow-up visit and case study at the Jewell Mound site is planned for FY96.

Bluestone Lake, West Virginia

Reservoir description

Bluestone Lake is located on the New River in the Appalachian Mountains of southern West Virginia in one of the most scenic parts of the United States.

The lake is an integral part of the Kanawha River Basin flood control system, whose purpose is to reduce major flood damages along the New, Kanawha, Ohio, and Mississippi rivers. The dam and lake derive their name from Bluestone River, which joins the New River about 2 miles above the dam. Construction of the dam started in 1942 following early survey and planning in the 1930s. Work was suspended during World War II and resumed in 1946. Work was done by private contractors under the supervision of the Huntington District of the Corps of Engineers. The dam has prevented more than \$100 million worth of flood damage from occurring, primarily along the Kanawha River.

The reservoir experiences a winter drawdown of about 4 to 1,400 ft NGVD from December 1 through April 15. Daily fluctuations of 1 to 1.5 ft are common. Numerous archaeological sites are located in the drawdown zone and the surrounding lands above the flood pool. Archaeologists from the Smithsonian Institution have found remains of numerous Indian camps along the New River, such as the large Indian town at Crump's Bottom.

Status of CRM

Bluestone Lake was visited by the author on August 1, 1995. The author interviewed the lake manager, who also serves as the cultural resource coordinator and the District archaeologist for the Huntington District. Following that meeting, a number of archaeological sites within and just above the drawdown zone were inspected.

The Smithsonian Institution conducted a preimpoundment survey of the portion of the New River Valley, which was to become Bluestone Lake. This survey identified a number of significant prehistoric sites including several large prehistoric villages. Additional sample surveys of the drawdown zone have added to the site inventory. With one notable exception (Site 46SU3), the majority of sites in the drawdown zone have not been formally evaluated for National Register eligibility. Site 46SU3, a village site affiliated with the prehistoric Fort Ancient culture, was tested by a team from the University of Pittsburgh in 1977. This site, which is located in the drawdown zone, has been determined to be eligible for the National Register. A National Register Thematic Nomination for Fort Ancient sites is now being prepared. Plans for a combination of data recovery and site stabilization for 46SU3 are underway. At the time this report is being written, it will also serve as a case study for the present work unit.

The National Register status of most of the recorded sites in the drawdown zone is undetermined at present. Erosion and surface collection have been observed at many of these sites by project personnel. To date, there has been no ARPA prosecution, although Title 36 citations have been issued for illegal digging in the vicinity of recorded sites. There is a draft HPMP that will be submitted for SHPO review upon completion. Monitoring and ranger patrols are routinely conducted during the winter drawdown for Sites SU3, SU9, and

others. More sample surveys to complete the inventory are planned for the future.

Impacts to historic properties

At this time, the Fort Ancient Village (46SU3) is the only National Register-eligible historic property that is being impacted by the annual draw-down. The site was inundated at the time of the site visit on August 1. The erosion of features documented in the 1978 work by the team from the University of Pittsburgh has continued according to the Huntington District archaeologist, who has visited the site several times. The mitigation of adverse effect to 46SU3 from the fluctuating water levels is regarded as a top priority for the Huntington District archaeologist. The team from the University of Pittsburgh gave the following background information on the site:

"46SU3 is situated on the farm known as Barker's Bottom....It is one of the richest and most desirable farmsteads in Summers County...During a major flood in 1891, the New River left its banks, stripping 18 inches of topsoil from the site and exposing a prehistoric graveyard. Purportedly, this graveyard covered at least 40 acres (Miller 1908). Whole and partial human skeletons were uncovered and in nearly every grave was found a "knife-shaped bone." Also recovered was a "peculiar pot of clay" and in one place a pile of nearly 200 children's teeth. Miller mentions the discovery of a stone turtle from the site which was recovered by Jonathan Lee Barker several years prior to 1891. The turtle was passed to John West of Alexandria, Virginia, who donated it to the Smithsonian Institution where it resides today...Miller also states that the old graveyard (46SU3) had been plowed over and cultivated for at least 100 years. Burials were described as being in a cramped and upright position. The graves were spaced 3 to 8 feet apart in an irregular formation. The burials were supposedly accompanied by animal remains as well as mussels and other shells. The flood of 1891 also washed out the prehistoric graveyard in Crump's bottom upriver....46SU3 was surveyed, recorded, and tested by Ralph S. Solecki of the Smithsonian Institution during the spring of 1948 as part of his survey of the Bluestone Reservation for the United State Army Corps of Engineers...Solecki excavated a 10 x 15 foot area on the site recovering a total of 131 potsherds, 2 black flint flakes, and 3 worked fragments of mammal bone (Solecki 1949). He also observed numerous burned and broken stones, bones, and mussel shells scattered throughout the area. With the aforementioned artifactual materials and materials from private collections, Solecki reported a 100-percent correspondence of the 35 non pottery traits listed for 46SU3 with Griffin's trait list on the Fort Ancient Aspect" (Griffin 1943) (Applegarth, Adovasio, and Donahue 1978:15).

At the conclusion of their detailed testing report, the University of Pittsburgh team made the following recommendations for the management of the site:

"Despite the fact that only 14.25 sq. meters (158 sq. ft) of 46SU3 were tested it is believed that the results of this operation warrant further extensive excavation at the site. While periodic and repeated inundation has caused serious disturbance of portions of the stratigraphy through fluvial perturbation and alluvial deposition, vast and potentially informative sections of the site are extant (emphasis added). Moreover, artifact preservation is excellent, notably in the ceramic and bone tool inventories, and the faunal assemblage is equally well preserved. Given the apparent size of this habitation as well as the continued destructive effects of the fluctuating water table, it is strongly suggested that any further work be undertaken in the near future." (Applegarth, Adovasio, and Donahue 1978:86).

46SU3 has been selected as a potential case study for the next phase of the work unit dealing with techniques for effective management.

Allegheny Reservoir, Pennsylvania and New York

Reservoir description

Allegheny Reservoir cuts through the Pennsylvania-New York state line in the heart of the beautiful Allegheny Mountains. The reservoir and adjacent lands comprise one of the largest and most popular outdoor recreation complexes in the northeastern United States. Almost the entire portion of the New York shoreline at this reservoir is bounded by the Allegheny Indian Reservation of the Seneca Nation. In Pennsylvania, the reservoir is completely surrounded by the Allegheny National Forest.

Kinzua Dam and Allegheny Reservoir is 1 of 16 major flood control projects in the Pittsburgh District. The project provides protection for the city of Warren, PA, from Allegheny River flooding, and in conjunction with other projects in the District, substantially reduces flooding in the Allegheny and upper Ohio River valleys. In addition to flood control, the project provides water to be released during dry periods. These releases help to maintain navigation depths for barge traffic on the Allegheny and upper Ohio rivers. They also have the effect of reducing pollution and improving the quality and quantity of water for domestic, industrial, and recreation uses.

Allegheny Reservoir experiences a 30-ft winter drawdown. Beginning in October with a summer elevation of 1,358 ft, the reservoir is gradually drawn down to 1,328 ft until it begins to refill in late March. Numerous and significant archaeological sites are exposed by the annual drawdown.

Status of CRM

The project was visited by the author on August 3, 1995. Since the Pittsburgh District has no professional archaeologist on staff at this time, the cultural resources coordinator from the Operations Division of the Pittsburgh

District attended the meeting at the project office. Also in attendance were three rangers from the Kinzua Dam project office, three representatives of the Seneca Nation, and two archaeologists from the Allegheny National Forest.

Because it is surrounded by the Allegheny National Forest, cultural resource management of the land surrounding the lake is the responsibility of the U.S. Forest Service. As explained to the author, the land above elevation 1,328 ft belongs to the Forest Service, and the Corps of Engineer has an easement to operate the reservoir for flood storage. Only below elevation 1,328 ft and at a few areas around the lake (e.g., Onoville Marina) are lands under-held in fee status by the Corps of Engineers. During the annual drawdowns to elevation 1,328 ft or less, the Corps has the responsibility for mitigation of adverse effects to historic properties as a result of the normal operation of the Allegheny Reservoir project.

In accord with the Archaeological and Historic Preservation Act of 1974, the Pittsburgh District has entered into an agreement with the National Park Service, Mid-Atlantic Region, to provide "...technical services for cultural resources inventory, evaluation, treatment, and planning" functions on the Allegheny Reservoir. The scope of work of that agreement includes areas located on the Seneca Nation known to have cultural remains as well as Corps fee property. Most of this work has been conducted by the Carnegie Museum of Natural History under contract to the National Park Service.

There has been a massive amount of archaeological research at Allegheny Reservoir. Most of it has been performed by the Carnegie Museum of Natural History under contract to the National Park Service. Important research first began in the Allegheny Valley in the 1950s. Since 1965, the Carnegie Museum has conducted almost continuous research in the area of the Allegheny Reservoir. Archaeological salvage excavations of sites within the conservation pool were conducted by the Carnegie Museum during each field season from 1968 through 1974.

Only portions of the reservoir drawdown zone have been intensively surveyed. A follow-up sample survey of the drawdown zone was performed in the 1980s, and opportunistic small surveys are presently conducted by the Forest Service during annual drawdowns. According to the Corps rangers at the August 3 meeting, surface collection, and even subsurface looting of exposed sites (Williams Bay), does take place, but very infrequently. A number of recorded archaic sites have been essentially destroyed by erosion, and numerous other potentially eligible sites are being eroded around the reservoir. One of these is the Sugar Bay Hopewell mound site located on the Sugar Run tributary.

To date, there have been no site protection projects in the drawdown zone. Monitoring and ranger patrols to thwart vandals during the drawdown is done infrequently. There have been no ARPA prosecutions or Title 36 citations issued. Long-term plans by the Corps and Forest Service call for the completion of the site inventory, testing of intact sites, and the mitigation/protection

of historic properties. A Historic Properties Management plan is projected for completion in the near future, depending on the availability of funds.

Impacts to historic properties

Inspection of sites during low-water episodes by Forest Service archaeologists show that artifacts in the area of major stream confluences such as Kinzua, Willow, and Sugar have been scattered by water action. Significant amounts of soil have been relocated on top of sites; and where sites could have been located surficially, the cultural materials have been removed. These areas probably experienced disturbance prior to inundation as the result of farming practices and oil and gas exploration. In addition, wave erosion is threatening the historic Riverview-Corydon cemetery where famous Seneca Chief Cornplanter is buried. In a status report to the Corps, Forest Service archaeologist Robert Scott reported the following:

“Wave action, and the erosion it produces, has been responsible for another concern on the reservoir. The west facing slope to the Riverview/Corydon cemetery has eroded significantly since 1964. The surface and sub-surface material in this area was deposited during glacial periods. It is a combination of sands, gravels, and sandstone conglomerate stone deposited by glacial outwash. This sort of geology does not lend itself to stability under normal conditions. Wave action from fluctuating water levels, spring storms, and the associated high water as well as recreation use have caused severe erosion problems.”

A proposed stabilization project in 1987 by the Pittsburgh District to protect the Riverview-Corydon cemetery was not implemented due to the prohibitive estimated cost. At this time, the erosion problem remains unsolved. This problem may represent a possible case study for the present work unit.

A number of archaeological sites around the reservoir, including the historic cemetery, were visited following the lengthy meeting. Representatives from the Seneca Nation escorted the Corps and Forest Service personnel to the grave of Seneca Chief Cornplanter. One identified historic property, located on Sugar Run, is a Hopewell mound site, which underwent a partial salvage excavation by the Carnegie Museum. This site may also be used as a case study for the present work unit.

Mansfield Hollow Lake, Connecticut

Reservoir description

Mansfield Hollow Lake, located on the Natchaug River in the New England Division, is part of the system of reservoirs and local protection works for the control of floodwaters in the Thames River Basin. The dam is located 5.3 miles above its confluence with the Willimantic

River at Willimantic, CT. Completed in 1952, Mansfield Hollow Dam has prevented an estimated \$35.7 million in flood damages to the communities of Norwich, South Windham, Baltic, Occum, Tuftville, and Willimantic.

The project office is located near the historic village of Mansfield Hollow. This area has been designated a State Historic District and placed on the National Register of Historic Place in recognition of its unique characterization of a 19th century rural New England village. Mansfield Hollow is a few miles south of the University of Connecticut campus in Storrs. The project area was home to the historic Nipmuck tribe, and evidence of their habitation is found throughout the area.

The flood storage area of the project, which is normally empty and is only utilized to store floodwaters, totals 1,880 acres and extends about 3 miles up the Natchaug River, 2.3 miles up the Mount Hope River, and 3.2 miles up the Fenton River. The project and associated lands cover 2,581 acres. The State of Connecticut manages the land around Mansfield Hollow Lake, which has become a popular recreational attraction in the area.

The lake experiences an annual drawdown of 3.5 ft down to elevation 211.5 ft NGVD during the winter months. Major drawdowns, down to elevations 204 and 205 ft, respectively, have occurred in 1974 and 1979. Another major drawdown related to dam maintenance is planned for the fall of 1995. Archaeological sites are exposed at that time, as well as during the annual drawdown.

Status of CRM

The project was visited by the author on August 7, 1995. The New England Division (NED) archaeologist participated in the meeting at the project office and joined in the inspection of shoreline areas that contain archaeological sites that are exposed during the drawdown. The lake manager for Mansfield Hollow was interviewed by the author. The lake manager for the NED's East Springfield Lake also participated.

The drawdown zone has been the subject of several archaeological sample surveys. The most recent survey at Mansfield Hollow was performed in 1994 by Normandeau Associates and the Public Archeology Laboratory for the New England Division. This effort covered the entire 2,439 acres of project lands in fee ownership around the lake. An intensive survey of the proposed approximate 40-acre drought pool was also conducted as part of the archaeological investigations. The upland survey identified an additional 31 prehistoric sites and verified the location of three of the original five recorded sites.

The proposed drought pool (measuring approximately 40 acres) around the lake perimeter was found to contain one newly identified and two previously recorded sites. Of these resources, two were assessed as being potentially National Register eligible. Both are being threatened by ongoing natural

processes (i.e., erosion from fluctuating pool levels) and collector activities. Further archaeological research (testing and possibly data recovery) is recommended for these two sites. The remaining site was assessed to have a lack of physical integrity, and no further archaeological investigation was recommended (Cherau and Russo 1994).

Ranger patrols are used to thwart vandalism of exposed sites during the winter drawdown. While there is known collector activity, there are no ARPA prosecutions or Title 36 citations on record at the project. The project OMP does address cultural resources and their management. A Historic Properties Management Plan is planned for the near future. There have been no data recovery projects or site stabilization projects at the lake. A proposed bank stabilization effort was proposed by the New England Division archaeologist a few years ago when an intact ceramic vessel was exposed by erosion. However, the project was abandoned when it was found to be cost prohibitive.

Impacts to historic properties

As noted above, there are two known significant archaeological sites located in the drawdown zone. Both of these sites are currently being impacted by fluctuating water levels. The lake manager reported that a major impact to the shoreline and to buried cultural deposits comes from ice, particularly in the early spring when it breaks up and large ice chunks cut significant gouges into the shoreline. Erosion from fluctuating water levels in the flood pool is also affecting some of the sites located in the upper arms of the lake according to the 1994 survey report. Vandalism is not a major problem, but the surface collection from exposed sites is not being adequately handled at this time. Impacts to significant sites are reported to the Connecticut SHPO, and plans for data recovery are in preparation.

Ball Mountain Lake, Vermont

Reservoir description

Ball Mountain Lake in central Vermont is part of the system of reservoirs and local protection work that control floodwater in the Connecticut River Basin. The dam was completed in 1961 at a cost of \$10.3 million and has thus far prevented \$83 million in flood damages. The dam at Ball Mountain Lake is located on the West River at the eastern edge of the Green Mountains. The reservoir provides flood protection to the downstream communities on the West River Valley, including Jamaica, Townshend, and Dummerston.

Ball Mountain Lake has a permanent pool of 20 acres with a stage of 25 ft. From mid-May to mid-October, this pool is enlarged to 75 acres, a stage of 65 ft, to increase the seasonal recreational opportunities and improve reservoir aesthetics. The flood storage area of the project totals 810 acres and extends 6.5 miles upstream through Londonderry. The project and associated lands

cover 1,227 acres. The section of the West River between Ball Mountain Lake and Townshend Lake has developed into one of the major centers of whitewater canoeing and kayaking in the East. The Corps makes controlled releases from both dams in the spring, generally on two consecutive weekends in late April and early May. There are also controlled releases from both dams in early October.

The 1986 Water Resources Development Act passed by Congress authorized the Corps to design, construct, and operate facilities that will enable upstream migrant adult Atlantic salmon to bypass the dams at Ball Mountain and Townshend lakes. The law also authorized the Corps to provide the necessary facilities for the downstream passage of juvenile salmon. The normal pool elevation of 60 ft at Ball Mountain Lake is reduced to 25 ft each year to attract the juvenile salmon (April thru mid-June), and one of the three manual flood gate controls has been replaced with an automated gate operator that will automatically regulate outflows to ensure that the 25-ft pool elevation will be maintained during normal flows.

The numerous drawdowns that occur annually expose archaeological sites located along the original river channel to erosion and vandalism. One of these sites has been determined to be eligible for the National Register of Historic Places.

Status of CRM

The Ball Mountain project was visited by the author on August 9, 1995. The New England Division archaeologist attended the meeting with the lake manager and then accompanied the author on a site inspection tour. There have been several sample surveys of the land surrounding the lake. Upland surveys of fee land above the drawdown zone have discovered numerous historic archaeological sites. The 1984 survey of the drawdown zone conducted by the University of Vermont included an evaluation of archaeological site VT-WD-36.

There have been no ARPA prosecutions and few Title 36 citations involving cultural resources. Site monitoring is performed at irregular intervals, but there is no coordination with the SHPO. The lake manager serves as the cultural resources coordinator. While there is a brief discussion of cultural resources in project OMP, there is no HPMP at this time. The major management goal is to control erosion at the one site in the drawdown zone that has been determined to be significant. In general, erosion rather than vandalism is the major problem at this project.

Impacts to historic properties

In 1982, the Consulting Archaeology Program at the University of Vermont conducted a limited archaeological reconnaissance survey at Ball Mountain Lake (Thomas, Doherty, and Warren 1982). Limited testing on a small terrace at the western end of the summer reservoir revealed moderate to high site potential. The terrace was considered vulnerable to the erosive action of the fluctuating reservoir maintained by the Corps. Further evaluation of the terrace's archaeological potential was recommended. This finally occurred in 1984 as a result of plans to convert the flood control dam to harness hydroelectric power. This involved maintaining the current summer reservoir level of 870.5 ft msl year round—an elevation just below the surface of the terrace. To determine the effects of this potential development on the terrace, the permit applicant, Hydroelectric Development, Inc., authorized a Phase 1 reconnaissance level survey and more extensive testing to determine the site's eligibility to the National Register of Historic Places.

A prehistoric site, VT-WD-36, was located during the first phase of study. More extensive testing, in the form of a block sample of 6.5 m² around a positive test pit, was the primary means of further evaluation. The site in question appears to be a Late Woodland (ca. A.D. 1000-1600) short-term base camp or hunting station (Thomas and Warren 1984). It appears to be a single component site with excellent integrity. One activity area was estimated to be about 54 m² (600 ft²). It contains diagnostic projectile points, a large amount of lithic debitage, burned bone fragments, and a possible hearth. All cultural materials were found in association with the possible hearth. The management options outlined in the testing report included the following:

- a.* Monitoring terrace erosion after stabilization with vegetation.
- b.* Data recovery prior to maintaining the reservoir at a permanent elevation of 870.5 ft msl.

At the time of the author's visit, neither of these recommended alternatives had been implemented. It may be safely assumed that erosion of the site is continuing at this time. The New England Division's management goal is still site stabilization and protection.

7 Conclusions

This report has concentrated on defining the nature of the impacts and the scope of the drawdown zone management problem. It has been shown that historic properties in drawdown zones have been and are continuing to be destroyed by erosion and vandalism. It has been demonstrated that the problem is geographically widespread, affecting every Corps District that manages reservoirs. It has also been shown that with current funding procedures, achieving total compliance with existing laws and regulations may be an unreachable goal.

While individual managers and archaeologists can make an enormous difference, new techniques and new approaches are desperately needed if the Corps is really committed to preserving the archaeological heritage that has been entrusted to its care.

A number of problems have been identified in the way in which historic properties located in reservoir drawdown zones are currently being managed in the Corps of Engineers:

- a.* There is a lack of "Baseline Funding" for the management of sites within drawdown zones. This funding is essential so that impacts that occur annually can be dealt with annually.
- b.* There is an insufficient emphasis on site evaluation (Phase 2 testing). The consequence of this is considerable uncertainty over which sites warrant future management, protection, and mitigation of adverse effect.
- c.* There is a lack of emphasis on the preparation of Historic Property Management Plans that deal specifically with the drawdown zone problem.
- d.* There is a lack of manpower and procedural guidance on law enforcement options needed to enforce ARPA and Title 36 in the drawdown zone.

- e. There is a lack of training on the part of cultural resource coordinators and insufficient utilization of available Corps expertise on site protection and stabilization.
- f. There is a lack of site monitoring, both in planning and implementation, to ensure the long-term protection and preservation of historic properties.
- g. There is an ineffective use of indirect management techniques to control visitor behavior.

Specific recommendations for dealing with this complex management problem will form the nucleus of the later part of this research work unit. It seems appropriate, however, to conclude here with a preview of ongoing research on two critical techniques for best practice cultural resource management, site evaluation and site monitoring.

Regarding site evaluation, it is important to note that evaluation strategies should not be exclusively limited to conventional archaeological test excavations. Conventional site testing has an important role in evaluation, but it is not an exclusive role. Briuer argues forcefully that site evaluation can also benefit from the use of new technologies such as GIS and geophysical remote sensing:¹

“The science of grappling with archaeological significance, explaining of cultural patterning, etc., resourcefully and parsimoniously wringing out every bit of useful and relevant information available, particularly in a regional framework and independent of geomorphological science, is a no less demanding and equally important enterprise. The science of significance evaluation is fluid and dynamic also.”

Dr. Briuer is now actively engaged in a multiyear research program sponsored by HQUSACE on the development of objective standards for assessing archaeological site significance. Funded through the Evaluation of Environmental Investments Research Program, this work unit includes the research of National Research Council Post-Doctoral Fellow, Dr. Clay Mathers. An important component of his work is the demonstration of how the combination of GIS and predictive modeling can provide for the broader, more rapid, and more efficient evaluation of archaeological sites and their significance. The “Significance Work Unit” seeks to make an important contribution to archaeological method and theory, and to the development of more comprehensive methods of site protection and preservation.

Regarding the monitoring of impacts to historic properties, development of a detailed Cultural Resources Monitoring Plan (CRMP) for each Corps reservoir would appear to be an essential first step in preventing significant site

¹ Personal Communication, 1995, Dr. Frederick L. Briuer, archaeologist, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

destruction and the loss of scientific data. In the course of field visits to nine Corps reservoirs, the author has seen that archaeological sites in reservoir drawdown zones quite often are adversely affected by a combination of geomorphic and human impacts. Sites initially exposed by erosion become targets for illegal excavation by pothunters, which causes even greater erosion and, ultimately, total site destruction.

The purpose of a CRMP would be to determine with the greatest possible precision how archaeological sites and other traditional cultural properties at a reservoir are being affected by the geomorphic processes of erosion and siltation and by the present human use of the reservoir. A CRMP integrated with a GIS-driven analytical geomorphic model could provide the archaeologist/land manager with the geomorphic conceptual tools and the baseline data onsite condition needed for truly effective cultural resource management.

In the approach now being developed at WES (e.g., Smith, Nickens, and Corcoran 1995), the potential of landforms within the project area to contain significant cultural deposits can be assessed using an analytical geomorphic model. A conceptual model for site impacts from both geomorphic and anthropogenic impacts can then be created and incorporated into a GIS database. A site monitoring program can then be designed that sets forth guidelines, methods/technologies, and identifies additional inventory and evaluation needs. The monitoring program can be refined following an initial pilot study and thereafter modified by the periodic re-examination of site impact data. This kind of approach is being tested by WES researchers at a number of Corps reservoirs in the Pacific Northwest. Whether it can be applied nationwide will be further explored in the next study phase.

In a later report, *Techniques for Effective Management*, this integrated geomorphic/archaeological approach as well as other techniques for site identification, evaluation, and protection will be examined so that the future management of historic properties in drawdown zones can be made much more effective. Much of the discussion in the later report will be structured around three case studies: Barren River Lake, Kentucky; Bluestone Lake, West Virginia; and Allegheny Reservoir, Pennsylvania.

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Photo 1. Grenada Lake, Mississippi: Interpretative sign at Civil War Confederate earthworks



Photo 2. Grenada Lake: View of upper flood pool during high water event



Photo 3. Grenada Lake: Eroded land surface in upper flood pool



Photo 4. Wright Patman Lake, Texas: Shoreline protection at Knight's Bluff site



Photo 5. Wright Patman Lake: Shoreline erosion in drawdown zone (Example 1)

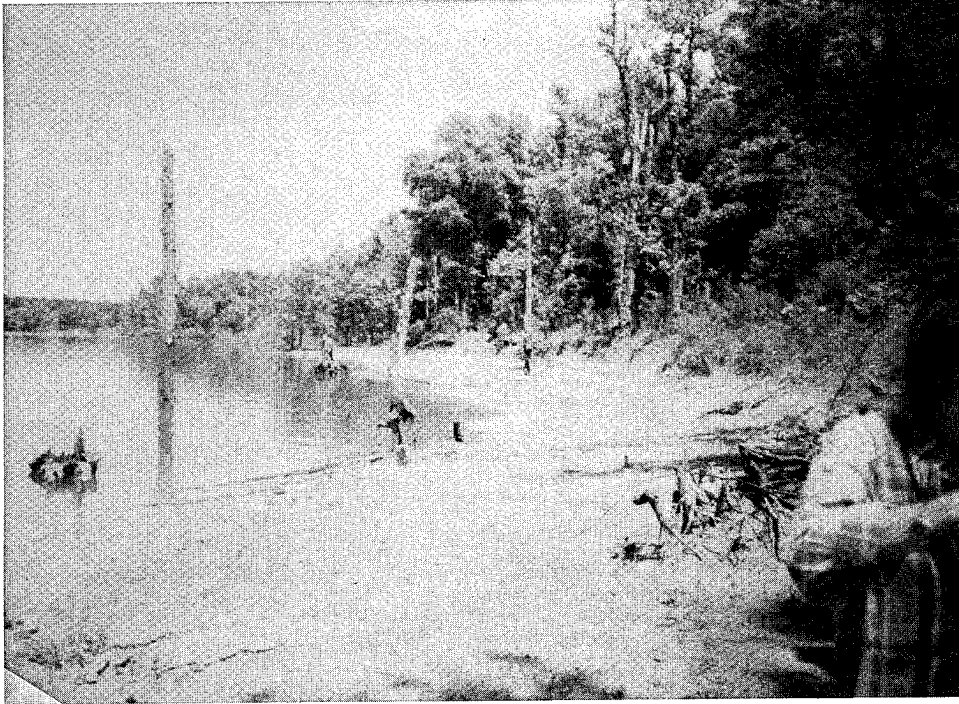


Photo 6. Wright Patman Lake: Shoreline erosion in drawdown zone (Example 2)



Photo 7. Eufala Lake, Oklahoma: Prehistoric bed-rock mortar at public use area



Photo 8. Eufala Lake: Bank collapse from toe erosion



Photo 9. Eufala Lake: Bank erosion in upper flood pool



Photo 10. Lake Barkley, Tennessee: Nashville District archaeologist monitoring archaeological site condition



Photo 11. Lake Barkley: Eroding feature (stone box burial) at the Hogan Site

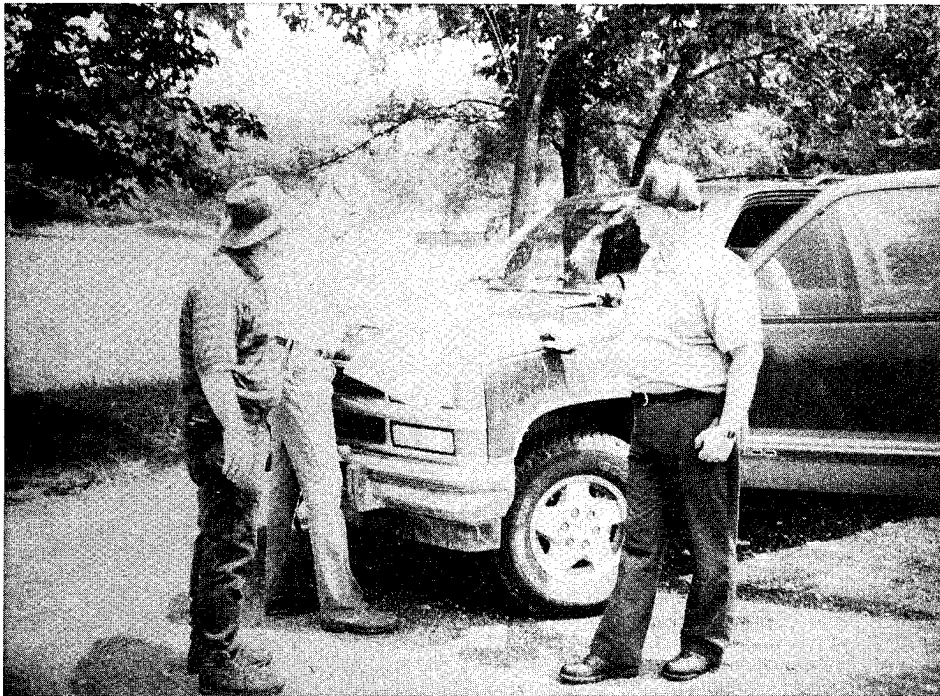


Photo 12. Lake Barkley: Cultural resource coordinator Steve Shaw and District archaeologist Rob Karwedsky



Photo 13. Barren River Lake, Kentucky: Site 15BN349, Robert Dunn (WES) and Barry Vessels (CEORD-PD-R) examining Burial 1995-1



Photo 14. Barren River Lake: Site 15BN349, Burial 1995-1 after removal of stone slabs showing exposed bone



Photo 15. Barren River Lake: Site 15BN349, stone box graves entangled in exposed tree roots along eroded bank

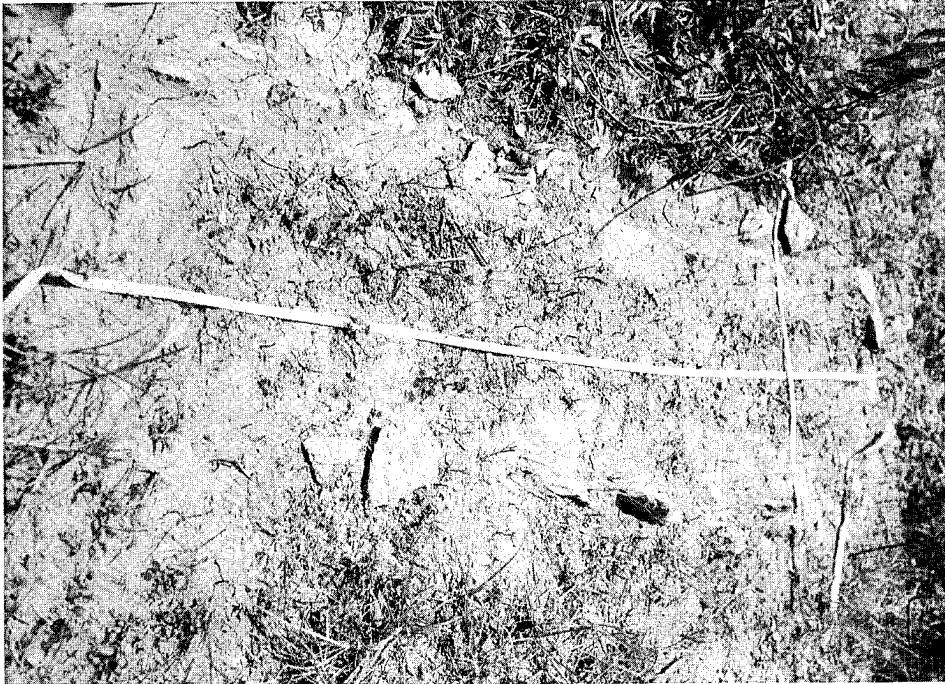


Photo 16. Barren River Lake: Site 15BN349, exposed outline of stone box grave (extended burial)

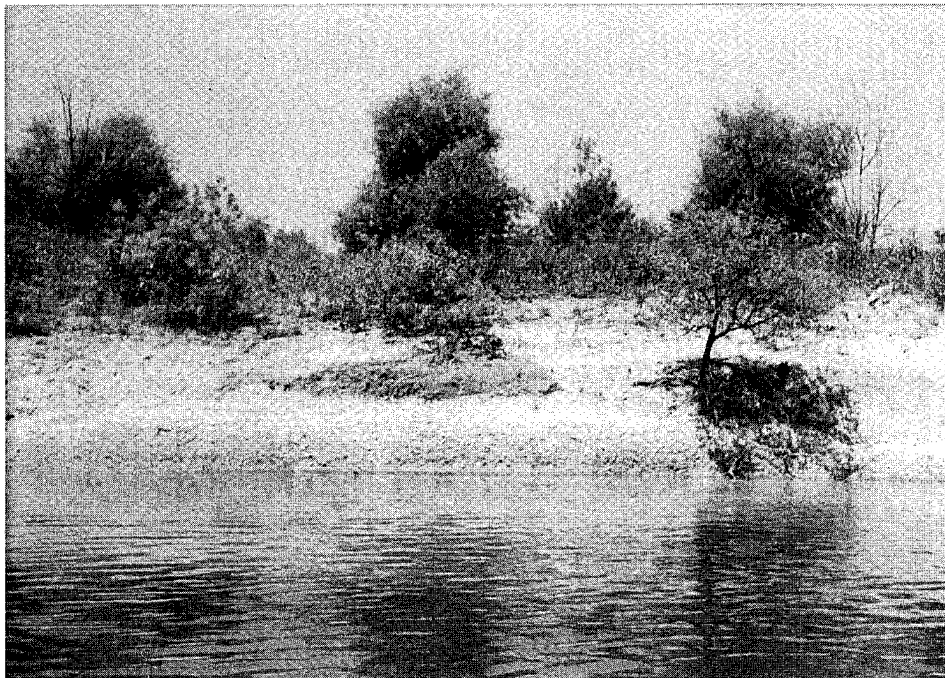


Photo 17. Barren River Lake: Site 15BN384, large archaeological feature exposed along eroded eastern bank

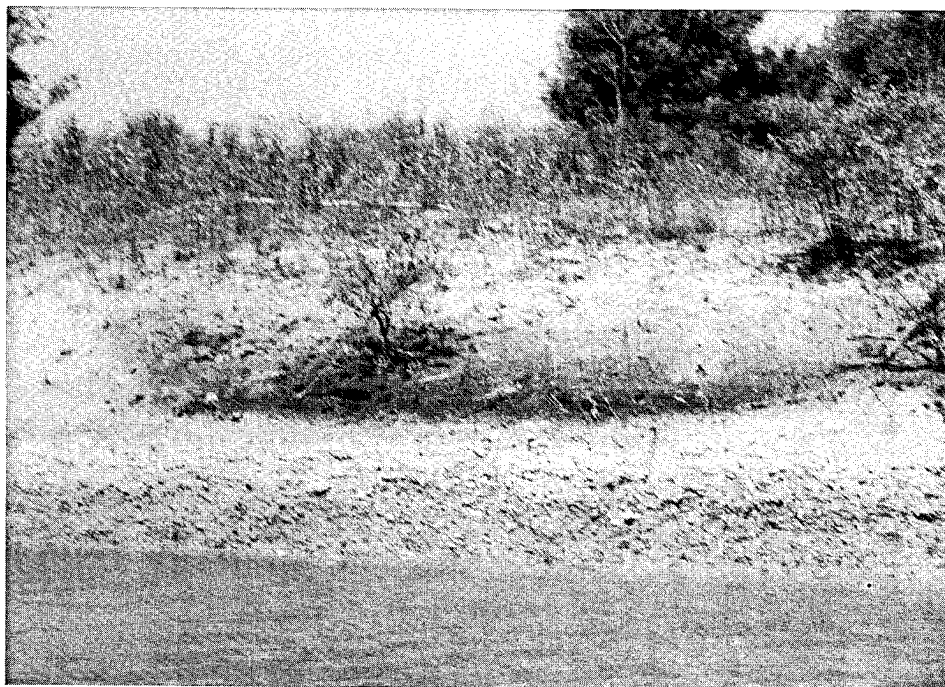


Photo 18. Barren River Lake: Site 15BN349, large archaeological feature exposed along eastern bank (possible house basin)

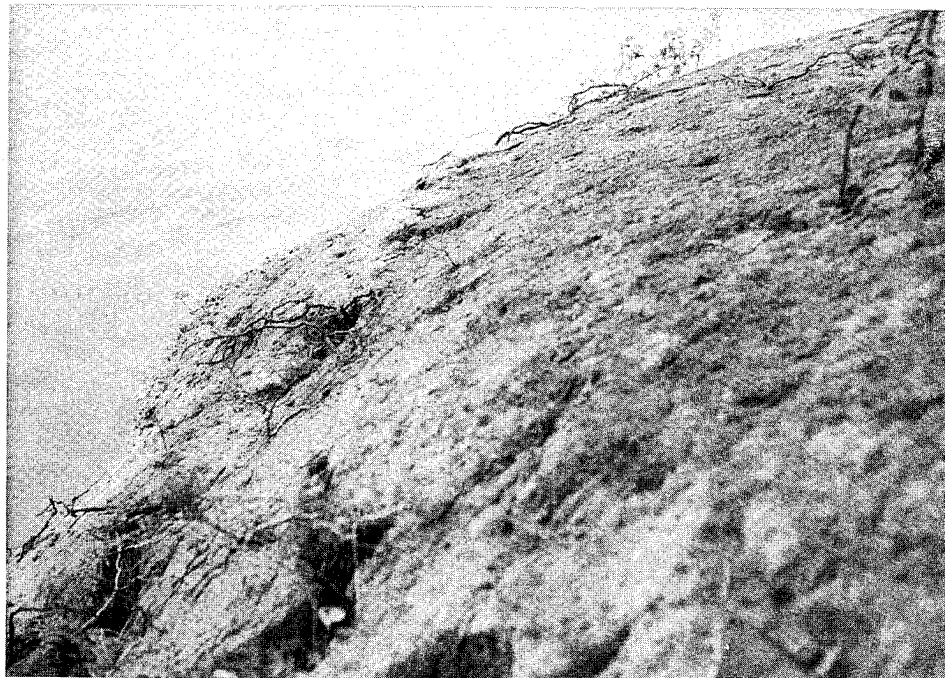


Photo 19. Barren River Lake: Site 15BN349, eroding north bank (possible buried middle archaic component exposed)



Photo 20. Bluestone Lake, West Virginia: Site 46SU3 (Fort Ancient Village) during winter drawdown



Photo 21. Bluestone Lake: Huntington District archaeologist Dr. Robert Maslowski



Photo 22. Bluestone Lake: Site 46SU3 inundated by high water at time of site visit



Photo 23. Bluestone Lake: View of inundated Site 46SU3 from present day island



Photo 24. Allegheny Reservoir, Pennsylvania: Meeting participants from U.S. Forest Service, the Seneca Indian Nation, and the Pittsburgh District



Photo 25. Allegheny Reservoir: Robert Dunn (WES) and Forest Service archaeologist Robert Scott discuss site conditions near the Sugar Run Mound Site

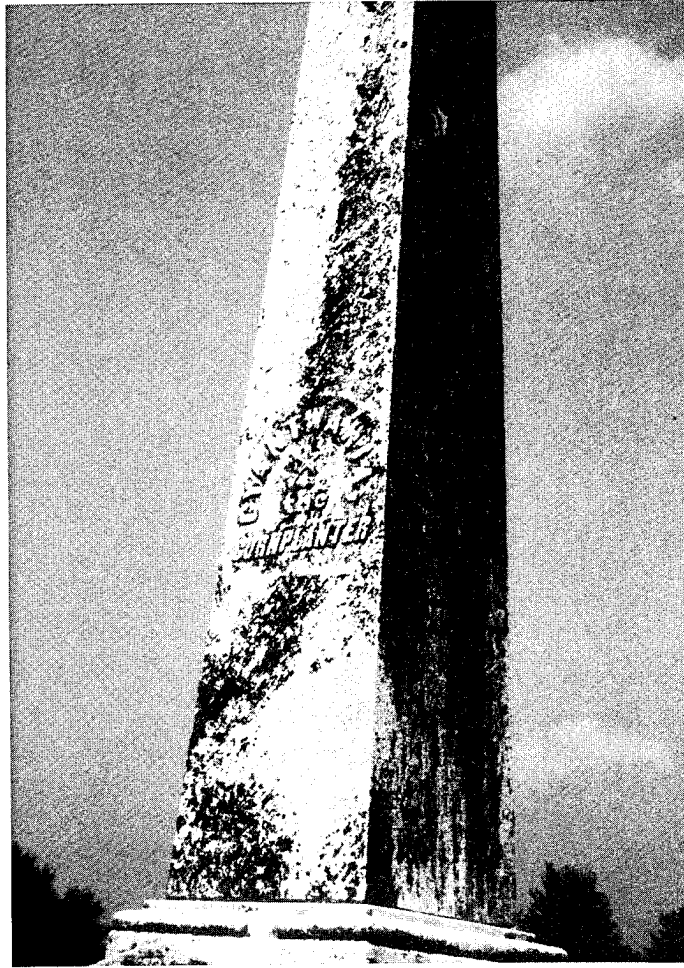


Photo 26. Allegheny Reservoir: Monument to Seneca Chief Cornplanter at the eroding Riverview-Corydon cemetery



Photo 27. Mansfield Hollow Lake, Connecticut:
Picturesque resident office near the
National Register-listed village of
Mansfield Hollow

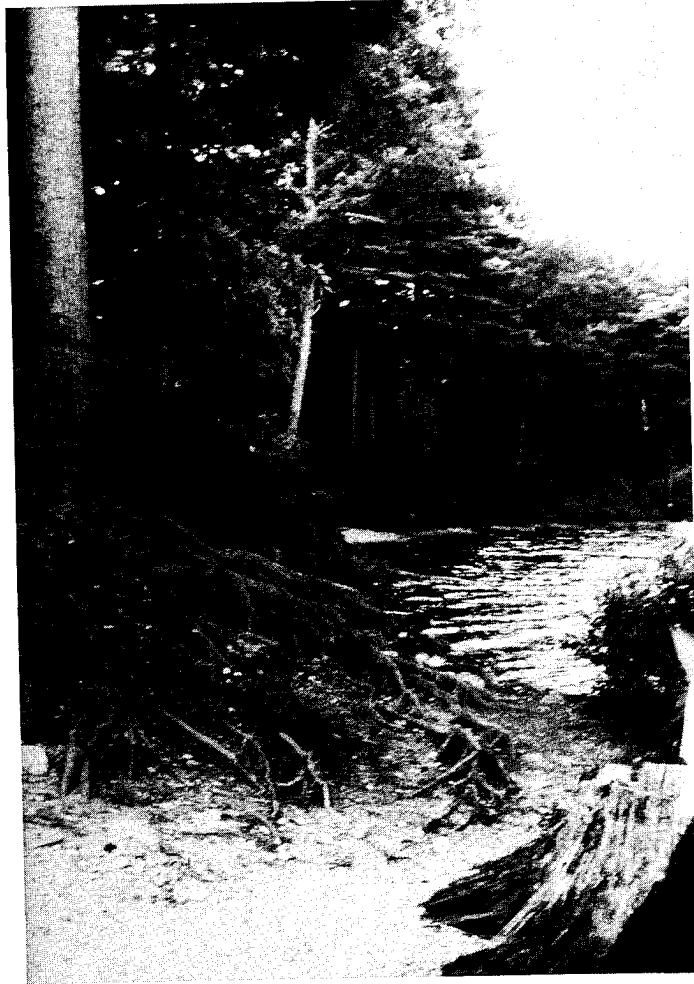


Photo 28. Mansfield Hollow Lake: View of eroding shoreline near recorded archaeological sites



Photo 29. Mansfield Hollow Lake: New England Division archaeologist Kate Atwood and lake managers Wayne Hawthorne and Ron Tribou

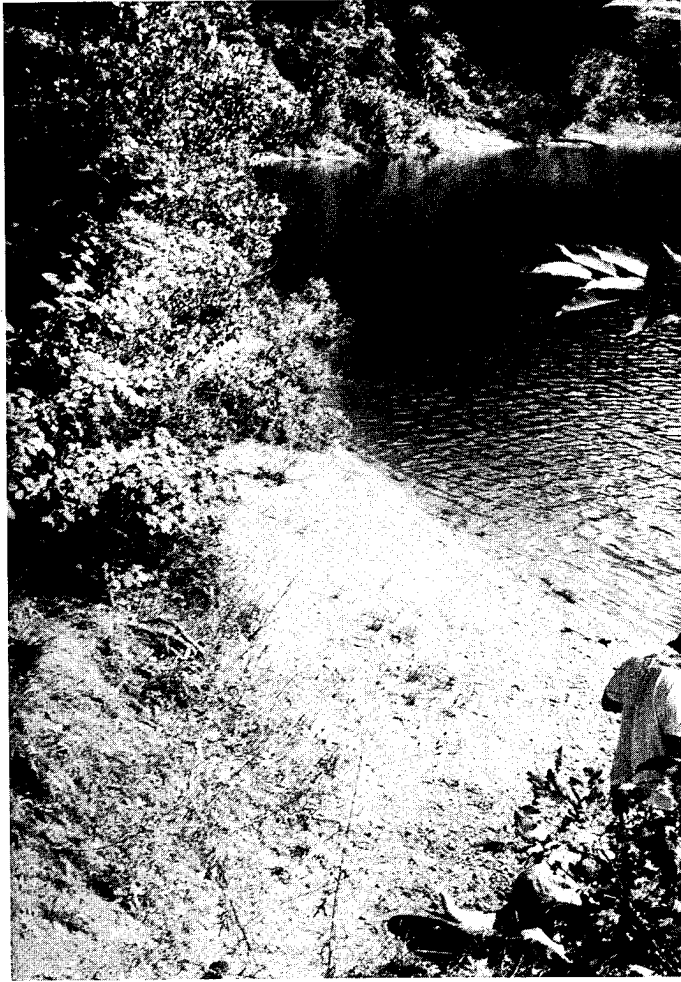


Photo 30. Mansfield Hollow Lake: Eroding shoreline
near recorded archaeological sites

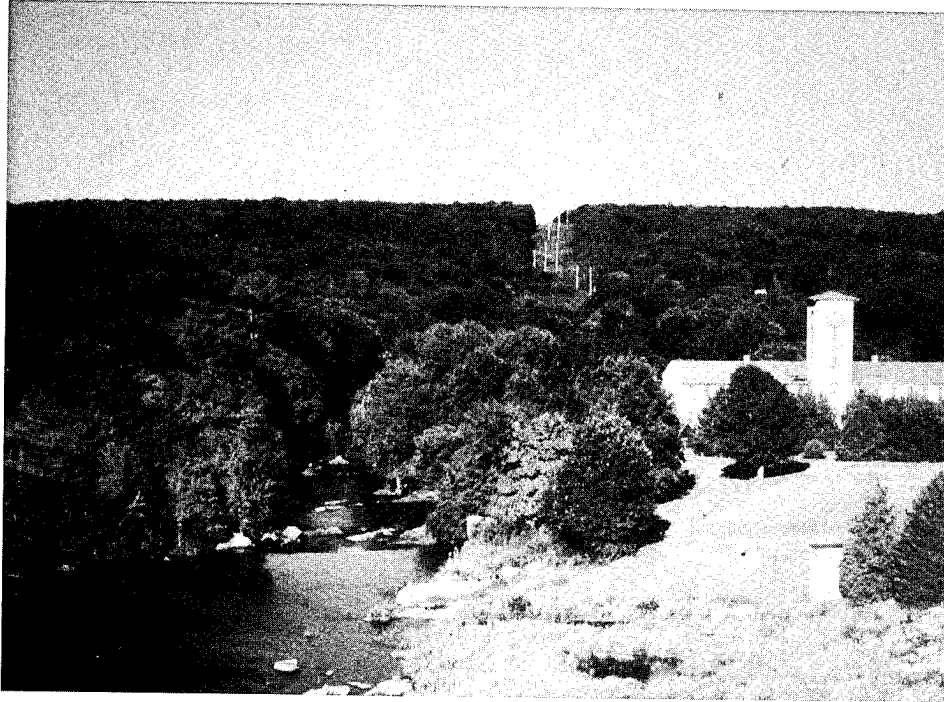


Photo 31. Mansfield Hollow: Tailwater Valley containing numerous historic properties



Photo 32. Ball Mountain Lake, Vermont: Upstream portion of reservoir during seasonal drawdown

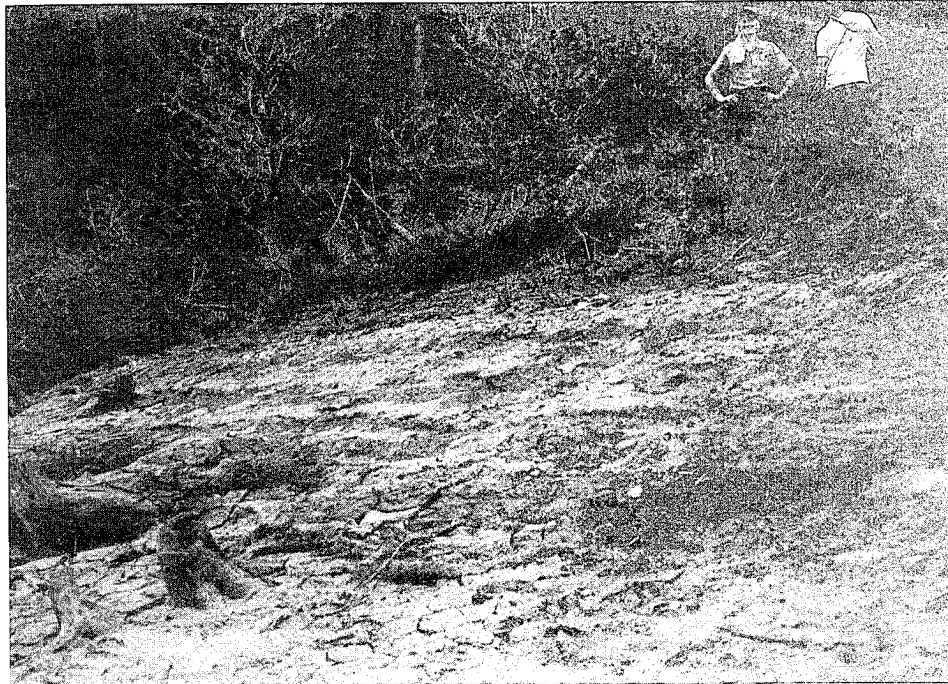


Photo 33. Ball Mountain Lake: National Register-eligible Site VT-WD-36 during seasonal drawdown

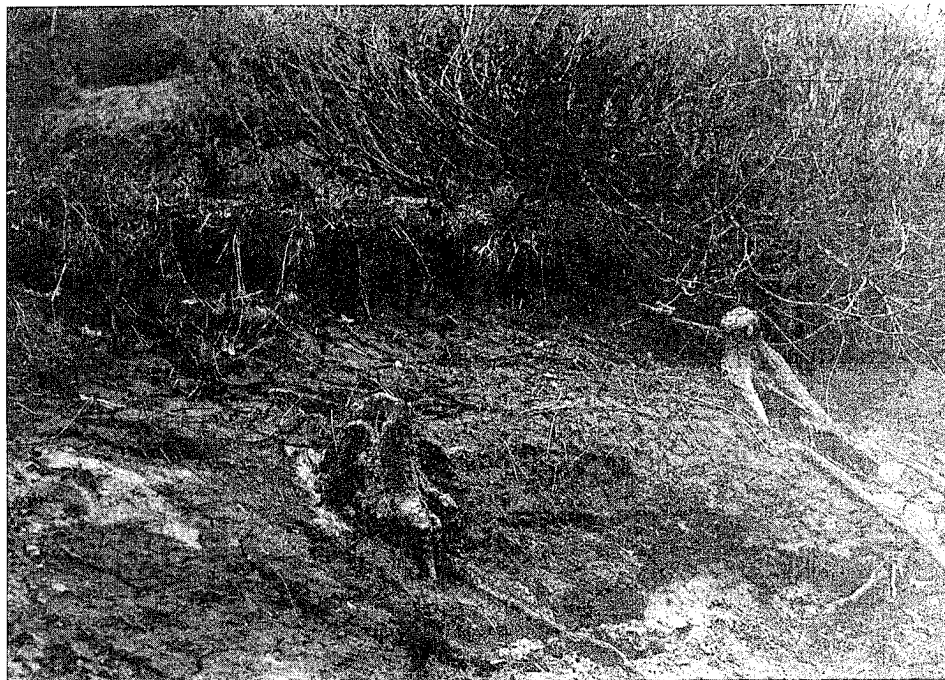


Photo 34. Ball Mountain: Site VT-WD-36 during drawdown

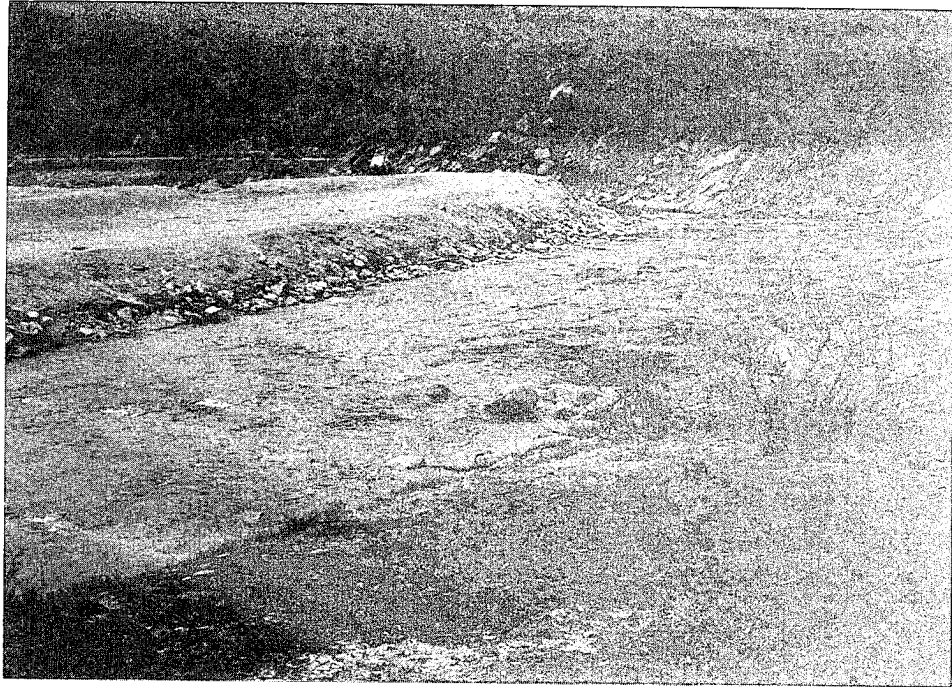


Photo 35. Ball Mountain: Site VT-WD-36 during drawdown

Appendix A

Sample Questionnaire

Responses



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KENTUCKY 40201-0059



CEORL-PD-R (1110-2-1150)

1 February 1995

MEMORANDUM FOR USAE Waterways Experiment Station, ATTN: CEWES-EN-R
(Mr. Robert Dunn)

SUBJECT: Drawdown Questionnaire

1. As requested, enclosed please find a completed questionnaire regarding drawdown information relative to archaeological sites in the Louisville District.
2. Please contact Anne T. Bader, archaeologist SOPA of this office at (502) 582-5696 if you have any questions regarding this matter.

Encls

Robert W. Woodyard
Chief, Environmental Analysis Branch



Army Communities Of Excellence Winner
Army's Premier District of Excellence

SURVEY RESPONSES
CEORL-PD-R

- 1a. See attached table.
- 1b. See attached table.
- 1c. See attached table.
- 2a. Of the 16 lakes in the Louisville District which are drawn down seasonally, 13 have been 100% surveyed for archaeological remains along the shoreline, i.e., in the drawdown areas between seasonal and winter pool levels. Two of the three remaining have been partially surveyed within the drawdown. None of the many sites identified as a result of these surveys have been evaluated for eligibility to the National Register.
- 2b. No sites within the drawdown areas are currently listed on the NR. The sites in these areas have not been evaluated for NR eligibility, and must be considered potentially eligible for listing to the NR. Based on survey data, many of these sites would likely have qualified for listing prior to inundation, and many may retain sufficient integrity for listing.

The drawdowns most certainly adversely affect the sites. For example, at Monroe Lake, which does not experience a seasonal drawdown, even normal fluctuation in the lake levels along with wave action have effected the loss of three prehistoric NR sites. A fourth NR site has been severely impacted due to its location along the shoreline. This indicates that a drawdown does not have to be particularly regular or extensive to adversely impact archaeological sites.

Several cases have come to the attention of this office in which archaeological sites have been protected through siltation within the drawdown zone. I suspect, however, that there may be a combination of erosion and siltation taking place at these sites. Furthermore, protection through siltation has the added disadvantage of precluding site discovery.

- 3. The sites are affected by sheet erosion, and shear (cut-bank) erosion through wave action, siltation, and looting.
- 3a. It is a well known fact that archaeological sites in the Louisville District are especially targeted by collectors during the winter drawdown.
- 3b. Sites in the floodpool have not been examined in the Louisville District to date. Of course, many of the sites located within the drawdown area extend into the floodpool zone and are therefore at least partially impacted. Specific impacts relative to the floodpool zone itself are not known.

- 3c. Currently, adverse impacts to sites within/along the drawdown areas are brought to the attention of the SHPO by means of the shoreline reconnaissance reports. As a general rule, no remedial actions to these impacts occur due to time and monetary constraints incurred with managing the large numbers of affected sites. In the case of Monroe Lake, coordination regarding the loss of National Register sites has escalated to include the Advisory Council.
4. Generally, the only remedial action associated with sites exposed in the drawdown area is that taken when human remains are observed. In these cases, very limited data recovery and/or erosion control (rip-rap) activities have been accomplished.
- 4a. Bank stabilization (i.e. rip rap) has been occasionally done when a site is on the National Register (Monroe Lake) or contains human remains (Mississinewa Lake). Routine monitoring has not been done to date, although it is recommended in the Historic Properties Management Plans that are currently being developed. While it is a good idea, the problem again comes back to time and costs.
- 4b. The HPMPs do address impacts to archaeological sites resulting from drawdowns. The discussion of the nature of impacts and possible remedies are drawn largely from the National Reservoir Inundation Study of NPS (1981) and the Archaeological Sites Protection and Preservation Notebook. Sites within the drawdown area are identified as high risk in the HPMPs, and site-specific impacts are discussed.
5. As mentioned above, surveys are nearly complete for the Louisville District which specifically target the drawdown area of the lakes.
- 5a. Because of time and monetary constraints, along with otherwise heavy workloads, virtually nothing is now being done in the Louisville District to protect the sites identified during the drawdown (shoreline) surveys.
- 5b. In the Louisville District, project uplands have not yet been inventoried for archaeological sites. Since these areas are protected and archaeological sites are at relatively low risk, I believe that this level of inventory should be postponed and efforts (money) devoted to evaluating the sites within the drawdowns. There are hundreds of such sites in the Louisville District, and the process will be expensive and time-consuming. However, I believe that it will prove to be the case that many of the sites have already been impacted to such a degree that no contextual integrity remains, and further stabilization/mitigation will be unnecessary.
- 5c. I have seen first-hand that the effects of fluctuating water levels are devastating to archaeological sites. Many very

significant sites have been lost. I feel that for the older lakes especially, the question may be largely academic, and that the damage has been done. However, in those cases where sites have undergone siltation, significant remains may be extant and retrievable.

6. There are numerous sites in the Louisville District that should provide good subjects for study. Perhaps the best is 15Bn21, the Jewell Mound.

* At Barren River Lake, a Mississippian mound complex and village site (15Bn21-the Jewell Site) was partially excavated prior to inundation. The platform mound is now an island during seasonal pool, but easily accessible during winter. This site should definitely be reassessed in order to determine the effects of drawdown and to ascertain the presence of any extant cultural deposits. A site visit is planned shortly by District personnel and the SHPO.

DRAWDOWN INFORMATION
LAKE PROJECTS, LOUISVILLE DISTRICT, OHIO RIVER DIVISION

LAKE	DRAWDOWN TYPE	FREQUENCY	ELEVATION CHANGE (Ft.)
Barren River Lake	Partial	Annual	27
Brookville Lake	Partial	Annual	8
Buckhorn Lake	Partial	Annual	25
Caesar Creek Lake	Partial	Annual	3
Cagles Mill Lake	N/A	N/A	0
Carr Fork Lake	Partial	Annual	10
Cave Run Lake	Partial	Annual	6
C.J. Brown Lake	Partial	Annual	3
Green River Lake	Partial	Annual	11
W.H. Harsha Lake	Partial	Annual	4
C.M. Harden Lake	Partial	Annual	21
Huntington Lake	Partial	Annual	12
Mississinewa Lake	Partial	Annual	25
Monroe Lake***	N/A	N/A	0***
Nolin Lake	Partial	Annual	25
Patoka Lake	N/A	N/A	0
Rough River Lake	Partial	Annual	25
Salamonie Lake	Partial	Annual	25
Taylorsville Lake	Partial	Annual	2
West Fork of Mill Creek	N/A	N/A	0

*** Although this lake is not routinely drawn down seasonally, normal fluctuation due to precipitation causes elevational variation of the pool. This, along with sustained wave action, has resulted in the loss of three prehistoric sites which are listed on the National Register of Historic Places. A fourth has been severely impacted.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
WILLIAM S. MOORHEAD FEDERAL BUILDING
1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186

CEORP-PD-R

2 March 1995

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers,
Waterways Experiment Station, ATTN: CEWES-EN-R
(Mr. Robert Dunn), 3909 Halls Ferry Road,
Vicksburg, MS 39180-6199

SUBJECT: Drawdown Questionnaire

1. Reference CEWES-EN-R memorandum dated 25 January 1995, subject as above, requesting information on archeological sites and impacts in reservoir drawdown zones through the enclosed questionnaire.
2. Our response to the subject questionnaire is enclosed. The point of contact for any questions is Mr. Conrad Weiser, Environmental Studies Branch, 412-355-3119.

FOR THE COMMANDER:

Encl

PAUL E. KOLESAR
Acting Chief, Planning Division

Printed on Recycled Paper

28 February 1995

WATERWAYS EXPERIMENT STATION SURVEY
TECHNIQUES FOR EFFECTIVE MANAGEMENT
OF
HISTORIC PROPERTIES ON LAKESHORES AND IN DRAWDOWN ZONES

INITIAL QUESTIONS:

1. a. Which lakes (reservoirs) in your district experience either partial or full drawdowns?

The Pittsburgh District has 16 reservoirs, one of which has no permanent pool (Union City Dam, PA). Of the 15 reservoirs with permanent pools, all experience at least a partial drawdown, although this may be as little as a few feet.

- b. Do these drawdowns take place seasonally, annually, or just occasionally?

Drawdowns are seasonal, generally beginning in late summer to after Labor Day depending on the project's purpose(s).

- c. Please provide the reservoir name, the type of drawdown, the frequency of drawdown, and the elevation change (depth of drawdown). Photographs may be attached to illustrate your response.

Project data sheets are enclosed which provide this information.

2. a. Have the areas exposed by the drawdown been adequately surveyed for cultural resources and the sites evaluated for the National Register?

No project has been adequately surveyed to identify and evaluate archeological sites in the drawdown zone. Our knowledge of sites in this zone is derived from cursory preimpoundment surveys, nonsystematic surveys by others and from amateur collectors.

- b. Do these drawdowns affect archaeological sites which are eligible or potentially eligible for listing in the National Register of Historic Places or the National Historic Landmarks Registry?

No archeological sites in the drawdown zone have been evaluated or determined eligible for the National Register or NHL. Five upland prehistoric sites at Berlin Lake affected by shoreline erosion have been determined eligible. There are

numerous sites with potential eligibility in the drawdown and shoreline zones.

3. Describe the nature of the impacts to these sites.

a. Are sites vandalized during periodic operational drawdowns?

Yes, primarily through surface collection, and in some cases this may be the most detrimental agent. Although not an archeological site, a historic stone arch bridge at Youghiogheny River Lake is exposed about once in five to ten years during low water. The primary impact to this bridge is not from inundation, scour or periodic exposure, it is from theft of the stonework during exposure.

b. Are sites being eroded by fluctuating water levels in the flood pool, etc.?

We suspect that sites in the drawdown zone are being impacted, but do not know the specific causal agents. Wave action at normal summer pool has been impacting National Register eligible archeological sites at Berlin Lake in Ohio. We suspect that wave action may also cause similar erosional impacts during drawdown. At other reservoirs, we have evidence of impacts through sedimentation or scour during periods of inundation in the drawdown zone.

c. Are such impacts coordinated with the State Historic Preservation Officer (SHPO)?

Shoreline erosion impacts at Berlin Lake, Ohio and Allegheny Reservoir in New York and Pennsylvania have been coordinated to some extent with the SHPOs. Nothing has been done to mitigate these impacts, however. Impacts specific to drawdown zone sites have not been coordinated.

4. Briefly describe current management practices for archaeological sites exposed during drawdowns.

a. Monitoring, bank stabilization efforts, archaeological data recovery, etc.

We have no formal management practices for drawdown zone sites.

b. Does the OMP or Historic Preservation Management Plan (HPMP) for the reservoir address impacts to cultural resources from drawdowns?

We have no completed HPMPs for any reservoir project. OMPs direct field personnel to notify the District's Planning Division if sites are identified or if ARPA violations are suspected.

5. Is there a procedure to locate sites when the lake is drawn down? If so, please describe it.

We have no such procedure.

a. What is now being done to protect these sites?

Nothing.

b. In your opinion, what should be done to protect these sites or the information they contain?

That would depend on their integrity. We contemplated a study at Mosquito Creek Lake to evaluate the effect of previous shoreline and drawdown zone erosion on the integrity of known sites, but we were unable to execute the study. We can speculate that after decades of drawdown exposure and possible erosion, sites in this zone have little integrity and may not warrant protection. On the other hand, we know of a site in the drawdown zone at Youghiogheny River Lake that has been buried by over three feet of sediment which protects it from surface collection.

If reservoir operation is considered an undertaking subject to the provisions of Section 106 of the National Historic Preservation Act, then these sites are subject to the same consideration and consultation requirements as others affected by construction, for example. In this case, significant sites which are being adversely affected would warrant mitigation in the form of protection or data recovery. We would prefer physical protection over data recovery, but realize that a case by case approach would be necessary.

c. In your opinion, how serious is the problem?

In our opinion, the problem is very serious. At our operating reservoirs, shoreline and drawdown erosion/exposure with its attendant surface collection/vandalism is probably more detrimental to archeological sites than all other management practices combined. Since most of our reservoirs were constructed prior to the Reservoir Salvage Act, there was little or no preimpoundment archeological survey work. Subsequently, this zone has exposed scores of sites whose numbers would probably increase significantly if a systematic inventory were undertaken. In addition to prehistoric sites, there is also the historical archeological component to consider where farmsteads and communities were razed during reservoir construction.

The seriousness of this situation is compounded by the general lack of institutional recognition of operational impacts to historic sites and by the Corps' budgeting process which prioritizes justification of O&M funds to construction over management-related impacts. With recent budgetary constraints we have not had cultural resources funds approved for anything but construction support, and in FY 95 we had no O&M cultural resource monies whatsoever approved.

6. Please nominate at least one candidate study project in your District for field visitation and more detailed study.

We suggest Mosquito Creek Lake, Ohio, and Shenango River Lake, Ohio and Pennsylvania, as two candidates having a significant number of known drawdown zone sites in potential erosional situations on federal lands. Kinzua Dam and Allegheny Reservoir, New York and Pennsylvania, also has a significant known population of sites in the drawdown zone located on lands owned by the Seneca Nation of Indians.



DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF:

CEORH-PD-B (70-1r)

28 March 1995

MEMORANDUM FOR Commander USAE Waterways Experiment Station,
ATTN: CEWES-EN-R (Mr. Robert Dunn), 3909 Halls
Ferry Road, Vicksburg, MS 39180-6199

SUBJECT: Drawdown Questionnaire

1. In response to your memorandum dated 25 January 1995, subject as above, the following is provided for your information.

Q1.a. Which lakes (reservoirs) in your district experience either partial or full drawdowns?

b. Do these drawdowns take place seasonally, annually, or just occasionally?

c. Please provide the reservoir name, the type of drawdown, the frequency of drawdown, and the elevation change (depth of drawdown).

A1.a.b.c.

John W. Flannagan Dam & Reservoir	- Winter Drawdown - 16'
East Lynn Reservoir	- Winter Drawdown - 6'
Alum Creek Lake	- Winter Drawdown - 3'
Beech Fork Lake	- Winter Drawdown - 8.5'
Bluestone Lake	- Winter Drawdown - 4'
Burnsville Lake	- Winter Drawdown - 13'
Deer Creek Lake	- Winter Drawdown - 14'
Delaware Lake	- Winter Drawdown - 5'
Dewey Lake	- Winter Drawdown - 5'
Dillon Lake	- Winter Drawdown - 3'
Fishtrap Lake	- Winter Drawdown - 32'
Grayson Lake	- Winter Drawdown - 8'
North Fork of Pound River Lake	- Winter Drawdown - 9.4'
Paint Creek Lake	- Winter Drawdown - 10.5'
R. D. Bailey Lake	- Winter Drawdown - 23'
Summersville Lake	- Winter Drawdown - 77'
Sutton Lake	- Winter Drawdown - 27'
Yatesville Lake	- Winter Drawdown - 6'

CEORH-PD-B (70-1r)
SUBJECT: Drawdown Questionnaire

Q2.a. Have the areas exposed by the drawdown been adequately surveyed for cultural resources and the sites evaluated for the national register?

A2.a. No.

Q2.b. Do these drawdowns affect archaeological sites which are eligible or potentially eligible for listing in the National Register of Historic Places or the National Historic Landmarks Registry?

A2.b. Yes.

Q3. Describe the nature of the impacts of these sites.

a. Are sites vandalized during periodic operational drawdowns?

b. Are sites being eroded by fluctuating water levels in the flood pool, etc.?

c. Are such impacts coordinated with the State Historic Preservation Officer (SHPO)?

A3.a.b.c. Unrecorded sites may be impacted by drawdown. Impacts include shoreline erosion, amateur collectors collecting on exposed sites, pothunting, etc. It has been suggested that a shoreline survey be conducted during drawdown to record sites uncovered by bank erosion. Such impacts are coordinated with SHPO on a case-by-case basis.

Q4. Briefly describe current management practices for archaeological sites exposed during drawdowns.

a. Monitoring, bank stabilization efforts, archaeological data recovery, etc.

b. Does the OMP or Historic Preservation Management Plan (HPMP) for the reservoir address impacts to cultural resources from drawdowns?

A4.a.b. The Historic Preservation Management Plan (HPMP) states that during drawdown a survey of the area should be conducted and a process developed for evaluating and managing archeological sites in conjunction with the State Historic Preservation Office (SHPO). The HPMP also states that the shoreline should be monitored during drawdown for eroding artifacts, features and sites.

CEORH-PD-B (70-1r)
SUBJECT: Drawdown Questionnaire

Q5. Is there a procedure to locate sites when the lake is drawn down?

- a. What is now being done to protect these sites?
- b. In your opinion, what should be done to protect these sites or the information they contain?
- c. In your opinion, how serious is the problem?

A5. No.

5a. In most projects nothing. At Bluestone we have a volunteer program for amateur archaeologists who monitor sites during drawdown.

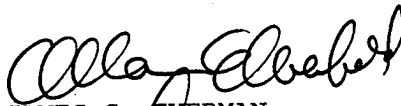
5b. Sites should be recorded, evaluated and mitigated by excavation or bank protection.

5c. Varies from project to project from minor to severe.

Q6. Please nominate at least one candidate study project in your district for field visitation and more detailed study.

A6. Bluestone Reservoir where a Fort Ancient Village is being impacted by drawdown.

2. If you have any further questions, please feel free to contact Dr. Robert Maslowski, District Archeologist, at 304-529-5712.


JAMES S. EVERMAN
Chief, Planning Division

Survey - Techniques for Effective Management of Historic
Properties on Lakeshores and in Drawdown Zones

Nashville District

1.a. Which lakes in your District experience partial or full
drawdowns?

Nashville District maintains ten (10) multi-purpose dams and
reservoirs along the Cumberland River and its tributaries. All
of the reservoirs experience at least partial drawdowns from late
fall to early spring.

b. Do these drawdowns take place seasonally, annually, or just
occasionally?

All of the reservoirs are subject to annual (late fall
through early spring) drawdown of varying magnitude. One
reservoir, Old Hickory Lake, is also subject to occasional
additional drawdown for shoreline structure maintenance by
adjacent land owners.

c.

<u>Reservoir Name</u>	<u>Elevation Change</u>
Lake Barkley (elevation may be dropped an additional 8' in advance of flood events)	5'
Cheatham Lake	3'
J. Percy Priest Lake (elevation may be dropped an additional 3' in advance of flood events or the pool raised an additional 14.5' for flood control)	7'
Old Hickory Lake (elevation is occasionally dropped an additional 2' for shoreline structure maintenance)	3'
Cordell Hull Lake	5'
Center Hill Lake (pool elevation may be raised an additional 37' for flood control)	30'
Dale Hollow Lake (pool elevation may be raised an additional 12' for flood control)	20'
Lake Cumberland (pool elevation may be raised an additional 37' for flood control)	50'

Laurel River Lake 36.5'
(pool elevation is totally dependent on in-flow and power generation, but is typically low in winter, high in summer)

Martins Fork Lake 10'

The drawdown for the above reservoirs is typically for the period of 15 October - 15 March. The additional 2' maintenance drawdown of Old Hickory Lake is accomplished over a two week period in the fall. The drawdown elevation change for Center Hill, Dale Hollow, Laurel River Lake, and Lake Cumberland includes the elevation change between the minimum and maximum power pool in addition to flood storage capacity (Laurel has no flood storage); the minimum power pool elevation is seldom reached.

2.a. Have the areas exposed by the drawdown been adequately surveyed for cultural resources and the sites evaluated for the National Register?

Drawdown areas, with some exceptions, have not been adequately surveyed for cultural resources. Exceptions include exposed drawdown shoreline when incidentally associated with cultural resource survey of adjacent recreation areas. Some minimal shoreline survey of sample areas was conducted at Lake Barkley and Cordell Hull Lake in 1981. Additionally, a long-term (2 year) survey of exposed shoreline at Cordell Hull and Old Hickory Lakes is currently being conducted.

b. Do these drawdowns affect archaeological sites which are eligible or potentially eligible for listing in the National Register of Historic Places or the National Historic Landmarks Registry?

Without adequate survey information the answer to the above question is difficult to address for all reservoirs. There is no doubt that day to day operation of the reservoirs, particularly the run of the river reservoirs (Cheatham, Old Hickory, and Cordell Hull), is actively contributing to the erosion of archeological site deposits along the shoreline. During drawdown, the bank and immediate shoreline areas are exposed to unauthorized surface collection, destructive wave action, and provide an access to exposed sites in the bank. Several significant, National Register eligible sites are known to be located within the drawdown area.

3.a. Are sites vandalized during periodic operational drawdowns?

Several of the District's reservoirs are very popular collecting sites during drawdown. In a few cases, significant sites are exposed in profile in the river bank during drawdown and are then actively dug into by vandals.

b. Are sites being eroded by fluctuating water levels in the

flood pool, etc.?

Fluctuating water level appears to be a significant contributing factor in the erosion of site deposits throughout the District at all projects.

c. Are such impacts coordinated with the SHPO?

SHPO coordination is initiated only in the case of significant deposits exhibiting illegal excavation and typically when the problem is brought to the District's attention by project resource management staff or concerned individuals from the public.

4. Briefly describe current management practices for archeological sites exposed during drawdowns.

a. Management practices?

Known problem sites and areas are subject to an increased level of monitoring and surveillance by project resource management staff and the District archeologist. In two cases in the District site exposures have been protected by placement of riprap to prevent further erosion and vandalism. No cases of archeological data recovery have been initiated.

b. Does the OMP or HPMP for the reservoir address impacts to cultural resources from drawdowns?

Neither the OMP or the HPMP (the HPMP's are incomplete at all projects) specifically address impacts during drawdowns; impacts are only addressed specifically in terms of Archaeological Resources Protection Act responsibilities and Section 106 compliance.

5. Is there a procedure to locate sites when the lake is drawn down?

There is currently a single project in the District that is specifically designed to locate sites during drawdown periods. The District has issued an ARPA permit to Dr. Kevin Smith of the Middle Tennessee State University for reconnaissance level survey of the shoreline, and adjacent uplands if necessary, of two District operating projects, Cordell Hull and Old Hickory Lakes. Actual field direction is provided by Mr. George Heinrich of the Middle Cumberland Archeological Society; volunteers from that organization provide labor for the survey. Very explicit guidelines apply to the recording and collecting of site materials, their subsequent analysis, and preparation of a final report. The Tennessee Division of Archaeology has graciously agreed to curate any collected materials and records generated by the survey.

a. What is now being done to protect these sites?

Increased monitoring and surveillance is the only activity that is being actively pursued to protect sites identified during drawdowns. The current survey of Cordell Hull and Old Hickory Lakes will be used as a model to address the issue of individual site protection.

b. What should be done to protect these sites or the information they contain?

A more comprehensive program should be developed that addresses site protection including those things that the District already accomplishes - monitoring and increased surveillance of known problem areas - along with an increased effort at data recovery where that is the only remaining alternative. Physical protection using riprap or similar techniques has proven helpful in that it discourages collection at that location; however, the collection and digging appears to just move to another location. The District also hopes that utilizing a local archeological society to conduct survey will serve as an education tool, discouraging illicit collection and excavation, and instilling an idea that these resources are a part of the Nation's common heritage. Simple enforcement of ARPA would also prove helpful, but project resources to accomplish that are limited.

c. How serious is the problem?

The problem is serious. A combination of forces, both natural and human caused, is slowly destroying significant resources along project shorelines. Annual drawdowns appear to contribute significantly to erosion of site deposits and provides access both to the drawdown area and to exposed banks.

6. Several different study projects come to mind. These include several individually significant sites that illustrate the problems associated with drawdown, erosion, vandalism, and potential for protection. I would nominate the District's Lake Barkley project for this study. Another study project could be formulated around the use of the Middle Cumberland Archeological Society, their findings, and recommendations. That study could be addressed at the completion of the first year of survey on Cordell Hull Lake - spring of 1995 - if their results prove promising.

POC: Rob Karwedsky, 615/736-5831

SURVEY

Techniques for Effective Management of Historic Properties on Lakeshores and in Drawdown Zones

Initial Questions:

1. a. Which lakes (reservoirs) in your District experience either partial or full drawdowns?

Lucky Peak Reservoir - Partial Drawdown
Dworshak Reservoir - Partial Drawdown

- b. Do these drawdowns take place seasonally, annually, or just occasionally:

Annually

NOTE: Due to current efforts in the Northwest to enhance salmon survival, Dworshak Reservoir also is being used provide additional flows during low water period in the summer. As a result, we are getting an additional drawdown starting in July/August. No idea how long this situation may continue.

- c. Please provide the reservoir name, the type of drawdown, the frequency of drawdown, and the elevation change (depth of drawdown). Photographs may be attached to illustrate your response.

Dworshak Reservoir; partial drawdown; annual (flood control) and seasonal (salmon); maximum authorized drawdown of 155 feet although never taken down to this level (full pool - 1600 ft, minimum pool - 1445 ft).

Lucky Peak Reservoir; partial drawdown; annual (flood control); maximum authorized drawdown of 150 which has been reached on a number of occasions (full pool - 3055 ft, minimum pool - 2905 ft).

2. a. Have the areas exposed by the drawdown been adequately surveyed for cultural resources and the sites evaluated for the National Register?

No.

Dworshak Reservoir - Partially surveyed.

Lucky Peak Reservoir - Surveyed a number of times in the 1960s and early 1970s. No sites found and no further investigations done since that time. However, Idaho SHPO believes further survey work should be considered.

b. Do these drawdowns affect archaeological sites which are eligible or potentially eligible for listing in the National Register of Historic Places or the National Historic Landmarks Registry?

Yes

3. Describe the nature of the impacts to these sites.

a. Are sites vandalized during periodic operational drawdowns?

Yes

b. Are sites being eroded by fluctuating water levels in the flood pool, etc.?

Yes

c. Are such impacts coordinated with the State Historic Preservation Officer (SHPO)?

We have discussed the situation at Dworshak Reservoir with the Idaho SHPO.

4. Briefly describe current management practices for archaeological sites exposed during drawdowns.

a. Monitoring, bank stabilization efforts, archaeological data recovery, etc.

Presently, monitoring of known site areas is being done. Discussions have been underway with WES regarding possible site protection/stabilization measures.

b. Does the OMP or Historic Preservation Management Plan (HPMP) for the reservoir address impacts to cultural resources from drawdowns?

There is no specific language in the Dworshak Reservoir HPMP addressing impacts to cultural resources caused by drawdowns. Discussions focus on impacts in more general terms such as who to contact if site disturbance is noticed, monitoring schedules, etc.

5. Is there a procedure to locate sites when the lake is drawn down? If so, please describe it.

Presently, we are trying to complete an initial survey within the drawdown zone at Dworshak Reservoir. Because elevation levels differ with each drawdown, the goal will be to conduct systematic surveys in all areas not previously covered in past drawdowns.

a. What is now being done to protect these sites?

Site monitoring is the only management action presently being done.

b. In your opinion, what should be done to protect these sites or the information they contain?

We need to complete site surveys/assessments (i.e. National Register eligibility status) and based on this information, take appropriate actions to insure site protection (e.g. data recovery, stabilization efforts, etc.).

c. In your opinion, how serious is the problem?

Many of the sites at Dworshak Reservoir are being seriously impacted by erosion and as a result we are losing site integrity and information.

6. Please nominate at least one candidate study project in your District for field visitation and detailed study.

Dworshak Reservoir.



REPLY TO
ATTENTION OF

CENED-PL-I

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

13 February 1995

MEMORANDUM FOR Commander, USAE Waterways Experiment Station,
ATTN: CEWES-EN-R (Mr. Robert Dunn), 3909 Halls
Ferry Road, Vicksburg, MS 39180-6199

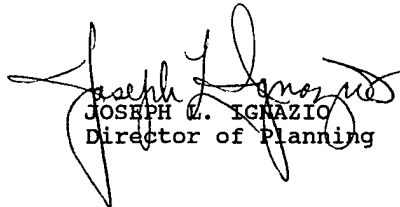
SUBJECT: Drawdown Questionnaire

1. Reference attached memorandum, CEWES-EN-R, 25 January 1995,
subject: Drawdown Questionnaire

2. Ms. Kate Atwood, NED Archaeologist, has completed the
attached survey on impacts to archaeological sites as requested
in the 25 January 1995 correspondence. Ms. Atwood recommends
Mansfield Hollow Lake and Ball Mountain Lake as candidates for
field visitation by WES personnel.

3. If you have any questions, please contact Ms. Atwood at
(617)-647-8537. FAX-8560

FOR THE COMMANDER:


JOSEPH W. IGNAZIO
Director of Planning

Attachments

SURVEY
TECHNIQUES FOR EFFECTIVE MANAGEMENT
OF
HISTORIC PROPERTIES ON LAKESHORES AND IN DRAWDOWN ZONES

INITIAL QUESTIONS:

1. a. See attached page.
 b. See attached page.
 c. See attached page.
2. a. Reconnaissance surveys have been completed at four of the six projects identified in question 1: Union Village Dam, Ball Mountain Lake, Barre Falls and Mansfield Hollow Lake. Two known prehistoric sites within the drawdown zone at Mansfield Hollow Lake have been evaluated as being potentially eligible for the National Register.

 b. One known prehistoric site at Ball Mountain Lake, that may be affected by drawdowns, has been determined eligible for the National Register.
3. a. Collecting has occurred at the Mansfield Hollow Lake sites for years. There has been a reputed instance of an individual selling an artifact (a soapstone bowl) from this area.

 b. The site at Ball Mountain Lake is being periodically monitored for erosion impacts. No impacts have occurred so far.

 c. Yes, at Ball Mountain Lake and no, at Mansfield Hollow Lake. However, the Connecticut State Historic Preservation Officer is aware of the vandalism problem at Mansfield Hollow Lake. The erosion monitoring plan was provided to the VT SHPO for Ball Mountain Lake as part of a salmon restoration project on the West River.
4. None
 a. Periodic monitoring at Ball Mountain Lake. No funding is available for bank stabilization efforts or data recovery.

 b. NED has no HPPs in place for any of our reservoirs. The OMPs do not address drawdown impacts on cultural resources.
5. There is no established procedure to locate sites when lakes are drawn down.

 a. At Ball Mountain Lake, we are monitoring periodically for erosion impacts.

b. Site evaluation and possible data recovery should be completed at all affected sites, since it is not likely that project operations will change.

c. The problem is moderate.

6. Ms. Atwood would nominate Mansfield Hollow Lake (CT) and Ball Mountain Lake (VT) for field visitation and more detailed study.

[1] From: VICTOR T HOM at CENED_ENGINEERING 2/7/95 8:43AM (1258 bytes: 21 ln)
To: KATHLEEN A ATWOOD at CENED_PLANNING_POST, PAUL J MARINELLI, VICTOR T HOM
Re: Requested
Subject: Drawdown Questionnaire from WES (Robert Dunn)

----- Message Contents -----

Reservoir Control Center is aware of this survey and understands that you would tabulate the following information to WES. Questions 1 a-c applies to us and the following is our response:

Project Name	Type of Drawdown	Frequency	Summer Pool	Winter Pool
Union Village Dam	Seasonal	1/YR	0 ft	20 ft
Ball Mountain Lake	Seasonal	1/YR	65 ft	25 ft
Tully Lake	Seasonal	1/YR	16 ft	11 ft
Knightville Dam	Seasonal	1/YR	0 ft	25 ft
Barre Falls Dam	Seasonal	1/YR	0.5 ft	4.5 ft
Mansfield Hollow Lake	Seasonal	1/YR	16.5 ft	10.5 ft

RCC doesnot have photos to show these minor changes in pool elevation.



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MD 21203-1715

CENAB-PL-EC (1105)

24 February 1995

MEMORANDUM FOR USACE, Waterways Experiment Station, ATTN: CEWES-EN-R
(Mr. Robert Dunn), 3909 Halsferry Road, Vicksburg, Mississippi 39180-6199

SUBJECT: Drawdown Questionnaire (Impact on Archeological Sites)

1. Reference memorandum, CEWES-EN-R, 25 January 1995, subject: Drawdown Questionnaire.
2. Please find enclosed the completed questionnaire regarding the effects of seasonal drawdowns on archeological sites at reservoirs within the Baltimore District.
3. If you have any questions regarding this matter, please contact Mr. Kenneth Baumgardt at (410) 962-2894.

A handwritten signature in cursive script, reading "James F. Johnson", is positioned above the typed name.

JAMES F. JOHNSON
Chief, Planning Division

Encl

Techniques for Effective Management
of
Historic Properties on Lake shores and in Drawdown Zones

Initial Questions:

1. a. Which lakes (reservoirs) in you District experience either partial or full drawdowns?

East Sidney, New York; Whitney Point, New York; Curwensville, Pennsylvania; Sayers Dam, Pennsylvania; and Jennings Randolph, Maryland.

- b. Do these drawdowns take place seasonally, annually, or just occasionally?

All but Jennings Randolph are winter season drawdowns for the purposes of flood control. Jennings Randolph is drawn down occasionally for flow augmentation.

- c. Please provide the Reservoir name, the type of drawdown, the frequency of the drawdown, and the elevation change (depth of drawdown).

East Sidney, New York, winter flood control drawdown, seasonal, 10' pool change. Whitney Point, New York, winter flood control drawdown, seasonal, 7' pool change. Curwensville, Pennsylvania, winter flood control, seasonal, 7' pool change. Sayers Dam, Pennsylvania, winter flood control, seasonal, 20' pool change. Jennings Randolph, Maryland, flow augmentation, seasonal, up to about 50 feet pool change.

2. a. Have the areas exposed by the drawdowns been adequately surveyed for cultural resources and the sites evaluated for the National Register?

East Sidney: lake has not been surveyed for archeological resources, no Section 106 evaluations have been conducted. Whitney Point: Limited archeological survey has been conducted, however, reports by local collectors suggest that additional survey is warranted, no Section 106 evaluations have been conducted. Curwensville: Phase I surveys have been conducted for new recreational sites, but not specifically for the drawdown. In 1992, a Phase I survey of the drawdown was conducted for the Curwensville Reallocation Study EA. Sites were located above the high pool level, but it was determined that there would be no affect in the drawdown zone, so no survey was conducted. The predictive model for the lake suggests that survey of the drawdown is warranted. NR evaluations have been completed only for the recreational sites. Sayers Dam: Minimal Phase I survey conducted by National Park Service prior to construction. Although National Register evaluations have not been conducted, further survey is warranted. Jennings Randolph: Comprehensive Phase I investigations were conducted in 1979, prior to completion of the dam. Field investigations documented that no National Register eligible sites are located in the drawdown zone.

- b. Do these drawdowns affect archeological sites which are eligible or potentially eligible for listing on the National Register?

With the exception of Jennings Randolph, little is known about the presence or absence of archeological sites in the drawdown zones. Therefore, it cannot be determined whether the drawdowns will have any affects on National Register sites.

3. Describe the nature of the impacts to these sites.

Due to the fact that the drawdown areas have not been surveyed, the nature of impacts cannot be assessed.

4. Briefly describe current management practices for archeological sites exposed during drawdowns.

Currently, there are no mandated practices for the treatment of archeological sites exposed during drawdowns.

5. Does the OMP or Historic Preservation Management Plan for the reservoir address impacts to cultural resources from drawdowns?

Currently, none of the five lakes have historic preservation management plans. The OMP for the five lakes do not specifically address the identification and evaluation of cultural sites within the drawdown zones.

6. a. Is there a procedure to locate sites when the lake is drawn down?

CENAB-PL-EC is currently preparing predictive models to identify highly sensitive areas at Operations sites, however, there are currently no plans to conduct identification/evaluation investigations at any of the lakes.

b. In your opinion, how serious is this problem?

There remains the potential for the drawdowns to affect unknown National Register sites, but due to the limited survey which has been conducted, the affects on significant sites cannot be assessed. Additional Phase I investigations are warranted at four of the five lakes.

7. Please nominate at least one candidate study project in your District for field visitation and more detailed study.

1) Curwensville; 2) Whitney Point; or 3) Sayers Dam.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

CESPK-CO-O (1130)

23 March 1995


MEMORANDUM FOR Commander, Waterways Experiment Station,
ATTN: CEWES-EN-R Robert Dunn

SUBJECT: Drawdown Questionnaire

The requested survey questionnaire is returned. POC for
questions or clarification in Joe Holmberg (916) 557-5281.

FOR THE COMMANDER:

Encl


D. A. Dennis
Chief, Construction/
Operations Division

ANSWERS TO SURVEY QUESTIONS

1. a. Ten of 11 reservoirs within Sacramento District experience partial or full drawdown (See 1c).

b. These drawdowns occur annually. Some years the drawdown is more severe than other years. In all years, the reservoir is drawn down to the bottom of the flood control pool at the beginning of the flood season (1 October).

- c. **Black Butte Lake**, annual flood control and irrigation drawdown, drawn down as much as 59 feet.
Eastman Lake, annual flood control and irrigation drawdown, drawn down as much as 121 feet.
Englebright Lake, continuous power regulation drawdown, drawn down as much as 77 feet.
Hensley Lake, annual flood control and irrigation drawdown, drawn down as much as 102 feet.
Lake Kaweah, annual flood control and irrigation drawdown, drawn down as much as 124 feet.
Martis Creek Lake, presently stores only a minimum pool.
Lake Mendocino, annual flood control, irrigation and M&I drawdown, drawn down as much as 128 feet.
New Hogan Lake, annual flood control and irrigation drawdown, drawn down as much as 137 feet.
Pine Flat Lake, annual flood control and irrigation drawdown, drawn down as much as 386 feet.
Lake Sonoma, annual flood control and water supply drawdown, drawn down as much as 203 feet.
Lake Success, annual flood control and irrigation drawdown, drawn down as much as 65 feet.

2. a. All areas exposed by drawdown have been surveyed and evaluated for the National Register.

b. In some cases (where entire Corps property has been designated as potentially eligible).

3. a. Some vandalization has occurred when middens have become exposed during operational drawdowns.

b. To some degree. Most serious erosion is occurring due to meandering of creek when reservoir is drawn down.

c. All fresh exposures of middens and recovery of artifacts and burials are coordinated through SHPO.

4. a. All known sites are monitored during drawdown periods. If artifacts and/or burials are exposed, Universities are secured for salvage efforts. Salvage efforts are coordinated with SHPO.

b. Both the OMP and the Historic Properties Management Plan address the effect of reservoir operation on cultural resources.

5. All known sites have already been recorded. There is no need for additional surveys to locate any potential additional sites.

6. Lake Kaweah is nominated for field visitation and possibly more detailed study.

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13. ABSTRACT (Maximum 200 words) This report deals with the nature and occurrence of impacts to historic properties along the shorelines and in the drawdown zones of Corps of Engineers reservoirs. It presents the 1995 survey questionnaire responses obtained from all Corps Districts and describes the management practices observed in field visits to nine Corps reservoirs. This report describes the scope of the "drawdown problem" and the variety of adverse impacts from erosion, biochemical effects, and vandalism. An overview of previous research to counteract these impacts is also presented.				
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Archaeology
Corps of Engineers
Cultural resources
CRM (cultural resources management)
Erosion
Fluvial systems
Geomorphic processes
Geomorphology
Historic properties
Inundation
National Register of Historic Places
Remote sensing
Reservoirs
Site decay matrix
Site evaluation
Site preservation
Site protection
Site significance
Site stabilization
Survey questionnaire